The

# Electrical Review

VOL. CVI. MAY 30, 1930. No. 2740.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

*Chairman and Joint Managing Director:* G. H. ALABASTER, COMPANION I.E.E.

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Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 6871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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# The Convention Papers.

THE papers read before the I.M.E.A. Convention this week related, as in previous years, to subjects of especial and present interest to those connected with electricity supply.

The main theme of the presidential address was rationalisation, but rationalisation approached in the spirit of "one for all and all for each," to quote from Mr. J. K. BRYDGES's introductory remarks; it is in this spirit alone, we believe, that enduring benefits can be obtained from this system of industrial organisation.

The president confined his theme to the electricity supply section of the industry, looking upon the Central Electricity Board as the authority for rationing supplies. His attitude may be defined as one of cautious optimism; he doubts the probability of economic advantage in the early stages, but hopes for ultimate benefit from the policy of centralisation. This point of view is not far removed from our own; we have always deprecated the raising of extravagant expectations of lowered costs in areas already well served electrically. We have stressed rather the advantages that should accrue from greater availability of supplies when the grid is in operation; we have also suggested that the true criterion lies in a comparison between conditions as they would be with individual and with co-ordinated working several years hence.

A point touched upon by Mr. Brydges—one concerning which we have no doubt much more will be heard in the future—is the danger lest savings brought about by more economical generation should be absorbed by the distributor, instead of being handed on to the consumer. He concluded his address with a tribute to the four bodies which have become vital parts of the electricity supply industry and whose efficient functioning

is necessary to its successful rationalisation, namely, E.D.A., E.R.A., B.E.S.A., and the E.A.W.

The obligations of electricity committees to municipal electricity undertakings provided a topic for the attention of the lay members of the Association, and, by reason of its reactions, of engineers also. Alderman R. S. Chatfield in his paper emphasised the elementary point that the duty of the electricity committee is to direct the policy of the undertaking and to take long views. Although this might appear obvious, experience has shown that the principle is not always grasped as it should be by committee men. Ald. Chatfield would make the electricity committee independent of the finance committee, and would, as far as possible, give it plenary powers. There is much to be said for this point of view, as a really strong committee, small numerically and unhampered by regulations suitable, perhaps, to non-trading departments, could be as quick in action and as flexible as a board of directors, with which its duties are in fact comparable; it has, we might add, the additional qualification of ability to raise capital upon more favourable terms.

Mr. G. H. Lake has once more placed the industry in his debt by his latest paper on pulverised-fuel firing. The debt is threefold: first, for the full particulars supplied of what has been accomplished in a modern power station under working conditions; secondly, for the form in which he gives these particulars; and, thirdly, for the promptitude of their publication—a necessary condition to meet the rapid developments of both pulverised-fuel and stoker-fired boiler plant.

Mr. Lake is, of course, very favourably disposed towards the former method of firing and, indeed, attributes recent improvement in boiler-house working (10 per cent. in three years in municipal stations), either to the use of pulverised fuel or else to the effect of its challenge. He also submitted that combustion, under modern conditions with powdered fuel, could be increased to rates not even contemplated until quite recently. Difference of opinion leads to progress, as Mr. Lake himself pointed out, and the echoes of the controversy set on foot by his opinions will (we hope) be heard for some time after the close of the Convention.

The last set paper, by Mr. J. W. Burr, deals primarily with a subject to which we have devoted some attention in these columns—the electric heating of large buildings. We say " primarily " because a great part of his paper is taken up with a clear exposition of the principles governing the determination of an undertaker's costs of supplying off-peak energy. The method adopted is to be recommended as a model for imitation.

Mr. Burr's data were obtained during the course of an investigation into the possibility of economically heating a new hospital by electricity. He found that electrode boilers (taking all incidental advantages of electricity into account) could compete with coal-fired plant, subject to a low price for electricity; a study of costs at his own station indicated the practicability of supplying the ten million kWh required per annum at a figure of 0.2d. per kWh. As Mr. Burr said, " the potential load from this class of heating is tremendous."

The papers, whose salient features we have referred to above, will be of value to many unable to attend the Convention. We have, therefore, arranged to reproduce them in abstract in subsequent issues.

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**Technical Developments in the Convention Area.**

For those attending the I.M.E.A. Convention who have time to give to sight-seeing professionally, there are many points of technical interest to engage their attention in the area, both in connection with the Convention programme and as " extras." No doubt the greatest interest is attracted by the grid sub-station of the Central Electricity Board at Brighton. All supply engineers in the country are, or soon will be, affected by the grid scheme and the general activities of the Central Electricity Board, and there are, no doubt, many attending the Convention to whom the Brighton sub-station presents the first opportunity to inspect grid equipment. A noteworthy feature is the transformer cooling arrangements, by virtue of the fact that forced cooling just doubles the capacity of apparatus under outdoor conditions. The development work which has led up to the transformer tap-changing voltage-control, and the incoming and outgoing metering systems, must result eventually in considerable advancement in connection with distribution and bulk-supply work generally. The practical limitations of the main 132-kV grid transmission line throws, perhaps, the greater interest on to the 33-kV line to Worthing, with its spun reinforced-concrete poles, the first, it is believed, to be erected in this country.

Bulk supply *versus* local generation is an all-important question, and the direct comparison which is to be rendered possible at Worthing is being looked forward to with more than usual interest, particularly as Mr. Geoffrey Porter, engineer and manager, Worthing, believes that local generation in his case will prove to be the more economical.

The whole-hearted manner in which the Eastbourne undertaking has set about preparing for its part in the national electricity supply scheme, under which it will cease to generate its electricity and take a supply from the C.E.B., reflects great credit on Mr. J. K. Brydges and his staff, particularly as the economical distribution scheme to be adopted has been made possible only by work put in hand a few years ago.

Brighton, of course, is now the most important station in the S.E. coast area, and while there appears to be some doubt about the advisability of continuing to run the less efficient plant in the station, the manner in which the installation as a whole has been brought up to a standard more in keeping with its " higher status " is highly creditable. The new turbo-alternator, with a thermal efficiency of 26.5 per cent., has resulted in a considerable increase in the overall efficiency of the station, while the boiler plant embraces several new features of interest, particularly in connection with the ash-removal arrangements.

There are some excellent examples of overhead-line work to be seen in the Hastings rural area, of which the " Aylesbury " pole, with its arrangements for a fifth wire for public-lighting switching, is of outstanding interest.

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**The Staff of Supply Undertakings.**

Two articles in this issue—those by Messrs. W. A. Jones and J. W. Thomas—place the point of view of the staff engineer before the lay members of electricity committees, a point of view which is not always fully appreciated by such members.

Mr. Jones, whose position as general secretary of the Electrical Power Engineers' Association invests his writing with authority, deals with the conditions likely to arise from the operation of the Central Electricity Board and shows what the E.P.E.A. is doing to enable its members to meet the changing situation. He also draws attention to a strange anomaly in connection with some municipal superannuation schemes by which a junior clerk appears to rank above a charge engineer. While on the subject of superannuation he makes an appeal for a measure of uniformity with regard to schemes, so that an engineer leaving one undertaking for another could carry with him his previously-acquired rights to a pension upon retirement, and not have to start all over again. Finally, the author mentions the forthcoming revision of the schedule of salaries and shows that a considerable difference of opinion exists between the two sides of the National Joint Board.

Mr. Thomas, who is both an able engineer and learned in the law, deals with the contractual relations between employer and employé in a general way, and then turns his attention particularly to salaries and conditions in the electricity supply industry. He shows how smoothly the Whitley system has operated in the industry during the last ten years, but thinks that the necessity exists for

a central office to co-ordinate the work and decisions of the District Boards and Councils. The question of compensation for the loss of employment or worsening of conditions under recent Electricity (Supply) Acts is discussed, and the problem of the temporary engineer is raised.

The remainder of Mr. Thomas's article is devoted to the subject of the qualifications and status of technical engineers, and the author suggests that the scope of the Workmen's Compensation Acts might be extended to cover men in receipt of more than £350 per annum.

We feel sure that a study of these articles will help members of electricity committees, as well as directors of supply companies, to a better understanding of the problems touched upon, leading to the smoother working.

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**Power Station Trends.**

IN this issue we include articles by well-known authorities on various aspects of electricity supply. Much has happened during the past few years to modify our views of the future, but in no case have prospects changed more radically than in the generation of electricity. The advent of pulverised-fuel and improvements in stoker-fired boilers, regenerative feed heating, inter-stage re-heating, higher pressures and temperatures, larger boiler units and greater turbine outputs at the maximum speeds have brought us in sight of thermal efficiencies that at one time seemed almost unattainable ideals. Many of these improvements have, or will, become practicable only as the result of heavy capital expenditure. As the goal is not only high thermal efficiency, but also low production costs, it has been a moot point whether the improvements in running costs justify the heavier standing charges on plant designed to take full advantage of the technical possibilities.

The position has changed latterly, in the main as a result of the increasing tendency towards the interconnection of power stations; it will be still more altered in favour of securing the lowest running costs at, if necessary, largely increased capital expenditure, as soon as the stations are operated under the grid.

Not only will the load factor of new stations then be higher than under individual operation, but the installed-plant load factor will be increased to an even greater extent. We envisage all sets running at the most efficient stations at their most economical loads, reserve being supplied both from outside and from the difference between economical and maximum continuous ratings. Thus capital charges on operation refinements will not have to be borne on idle plant. It is not unreasonable to expect, also, that as what is now an advanced type of design becomes standard practice, so will the capital costs come down.

In his article on steam conditions and cycles, Mr. J. N. WAITE states the case for high initial temperatures, high pressures, and resuperheating in base-load stations. He substantiates his views with figures that should be quite easily obtainable on a commercial basis. Mr. Waite believes that the future of steam power stations is bound up with high-pressure, and hopes that manufacturers and users in this country will lead instead of follow in the high-pressure field.

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**Switchgear Testing.**

THERE has in the past been some scepticism regarding the short-circuit ratings of switchgear, at all events for the heavier duties. Until recently there was indeed some justification for a cautious acceptance of such ratings, since it has been difficult to test switchgear for duties such as are inherent in the modern conditions. It is therefore natural that those responsible for the safety of employés and plant should regard with some concern the growth in magnitude of the energy that might be liberated under short-circuit conditions.

We therefore welcome the opportunity of drawing the attention of supply engineers to Mr. H. W. CLOTHIER'S article on the plant installed at Hebburn for producing heavy short-circuits to test apparatus to destruction. It is possible to test complete three-phase circuit breakers up to 66 kV, and single-pole units of three-phase circuit breakers up to a pressure of 132 kV, for the interruption of short-circuit energy up to 1,500,000 kVA. The scheme includes the provision of automatic recording devices which provide accurate and complete records in a permanent form.

The achievement is a notable one, and eliminates one more of the "hit or miss" methods of determining measurements—methods which, however creditable to the ingenuity of pioneers, are out of place, even when not actually dangerous, in the present stage of electrical development.

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**Rural Economics.**

WE have found it necessary from time to time to deprecate the facile assumption that, because countryfolk would undoubtedly gain much from the use of electricity, they would therefore be only too ready to use it freely when it was brought to them, and that it would provide a lucrative load for the undertaking.

Those who have had experience of supplying electricity in rural areas will be able to appreciate the difficulties of making a commercial success under the conditions outlined by Mr. W. C. BEXON on a later page. Mr. Bexon speaks, of course, with considerable experience of supplying electricity in sparsely populated areas, and those who attended the I.M.E.A. Convention in 1927 will remember his most informative paper on the subject. His word of caution to municipalities which are considering rural schemes should be read in conjunction with his constructive suggestions of views on the conditions under which rural electrification could soon become an accomplished fact.

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**The Two-part Tariff.**

A GREAT deal has been written about the two-part tariff, yet there always seems to be some new light to throw on it.

Mr. D. J. BOLTON in his contribution to this issue deals with the proportions that should be allocated to standing and running charges, respectively. One of the difficulties of applying a maximum demand tariff to domestic electrification is the diversity factor arising out of the complex relations that exist between the individual demand and the class demand. Mr. Bolton analyses the tariffs of several undertakings, showing that they are generally weighted in favour of the low load-factor consumer, on the assumption that his diversity factor would warrant discrimination in his favour.

The two-part tariff, as generally applied, is shown to owe far more to commercial expediency than to any serious attempt at scientific adjustment. Provided that the tariff is based upon a clear understanding of production costs, and that additional output is not sold at less than the running cost plus the standing charges on special expenditure, any divorce between costs and tariff is of no consequence to the consumer. The latter is concerned only with the commercial suitability of the tariff. We use the word "commercial," of course, in the sense of the ascertainment of the requirements of the consumer, for which purpose the undertaking exists.

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**Industrial Heating.**

ELECTRIC heating taken as a whole offers greater potentialities than any other field for the use of electricity. In industry where quality of product is becoming of ever greater importance than the cost of the heat itself, it is tending to assume a less important position in the balance of expenditure.

Mr. W. Y. ANDERSON, in an article based upon first-hand experience of electric heating in its several aspects, naturally devotes a great proportion of his remarks to the heat-treatment of metals; this might be expected from the initiative shown by Birmingham Corporation in developing the electrical furnace load. His figures relating to costs obtained with furnaces of various types, and to the practical arguments in favour of their installation, should prove useful to the many supply engineers who are turning their attention to this valuable and highly technical class of business.

Haines, London.

# Women and Electricity.

By LLEWELYN B. ATKINSON M.I.E.E.

THE year 1924 saw the definite entry of women into the movement for universal electrification and, as was proper, that movement, so far as women are concerned, was to concentrate upon the home in all its forms. Perhaps even its pioneers hardly saw the difficulties of getting a start, or realised how rapid the spread of the idea was to be once a start was made. Much has already been done; much educational work among the pioneers themselves, organisations have been set up in the larger towns, groups and committees have been formed, and the needs and possibilities of women's work have been explored. How well the foundations are laid may perhaps be best judged by the fact that no gathering for electrical propaganda or salesmanship is complete unless representatives of the women's organisation are present.

*Fig. 1.—A native woman of the backward races grinding by hand the grain which presently she will bake into some kind of biscuit or unleavened bread.*

*Fig. 2.—A modern house-wife peeling by hand, very wastefully and with the loss of the best part, the potato which, when most of the vital part has been dissolved from it by boiling water, will feed her family.*

This will continue and the work will expand; the teaching of how electricity when cheaply supplied may simplify and lessen the working of a home, will penetrate the social strata layer by layer so far as its applications to the present types and organisations of houses permit. But is this enough? May we not look forward somewhat? May we not stop and think what might be done by women in utilising electrical energy in its various forms to emancipate them from physical routine drudgery as part of the maintenance of a home? We know that in the earliest beginnings of human family life, and in the backward races of to-day, the man spends his time hunting and the woman does all the rest to nourish her man and their children. Civilisation could not begin till slavery or servitude, call it what you like, was established. Culture requires leisure from the daily round of obtaining or producing food, clothing and shelter, and the earlier civilisations became possible when hunting and the nomadic life, in which constant change of place was essential, were replaced by agriculture and by domestic animals, since they permitted the work of each person to suffice for more than the basic needs of one, and so leisure became possible, given the power of one group to appropriate part of the surplus production of another group. And so by slavery, by serfdom, by hired labour, leisure was to be found for some, but not for all. The problem which civilisation is trying to solve step by step is how leisure may be uniformly distributed and not confined to certain groups or classes only. We have found the secret, but we apply it slowly and tentatively. Slavery has been nearly abolished, serfdom in the advanced modern state has gone, hired labour is going. By that I do not mean that a wages

system as a means of distributing the product of production is going, but that as a means of transferring part of the product from one group to another it will cease. Leisure in the future will be the possession of all alike. This is being accomplished step by step, first by tools still operated by human power, then by machinery driven by power. Henry Ford has remarked that we speak of this as the Age of Machinery; we should speak of it as the Age of Power. But do we realise that in the home we still are using very little machinery and power? Even in the domestic electrical appliance we use very little power, and so it remains that with all that has been done to introduce electricity into the home, the need for human routine drudgery remains, and, indeed, we know that unless to-day the woman in the home can employ, and can get, paid assistance she can have very little leisure.

And so for women, if they are to emancipate themselves from a never-ending circle of tasks that end where they begin, that produce no satisfaction to the great majority, they must put on their thinking caps and devise *new methods of living*. This is the task which those who are joined in the Electrical Association for Women might well undertake. What a goal to aim for, what enthusiasm it might well create! Woman, by her own effort, has emancipated herself socially and politically; is it not curious that in the home, where historically and by Nature's decree she has been placed, she still is shackled and enslaved? "Leisure for all women through organisation and the use of power." What a slogan!

Many readers of these lines will have visited the Ideal Home Exhibition at Olympia in the month of April. A very wonderful and a very delightful exhibition of things new and old, beautiful and useful, for the equipment of homes. There was a Palace of Light, indeed a palace of dreams, for most people of the dreams of fantasy far removed from the realities of existence.

**Fig. 4.—A modern Communal Home for Young Women in Prague.**

But the thought which came into my mind as I walked round was this: What do these throngs of people, mostly women, come here to see? Not how they may equip and order their homes, for most of these things, palaces of light, gardens of delight, are for the few who may command what they wish. Turn to "The House that Jill Built." What was the prevailing idea therein? It seemed to me it lay in this: that everything should be put away in a cupboard; that no object, no moulding on the wall or on the doors or furniture should remain outside to catch one speck of the dirt and grime of our cities; that all the dirt should reach the floor whence the electric suction sweeper should remove it. Good so far as it goes — even necessary —but was there anything in that home that removed the woman's daily and hourly task of cooking and cleaning up after meals? If that home really represented what woman to-day wants, it can only be because she has not thought of the possible.

**Fig. 3.—A woman of the future in a "rationalised" housework apartment with pleasant surroundings and unrestrictive clothing.**

Henry Ford, in his recently published "My Philosophy of Industry," deals briefly with this theme. His solution appears to be to follow in the case of daily meals what has already been done in that of bread, that is, have them prepared and cooked outside and delivered hot at the appropriate moment; the service articles, plates, cups, cutlery, are presumably to be collected and cleaned at the central factory. It may be one solution, but it does not solve the problem for the great mass of women, because the proposition that all should have leisure implies also that all should share in the work, not that a special staff should be employed and paid for.

I think a more hopeful line of attack, and this is what I suggest for study, is to envisage blocks of flats with service, or even to visualise a modern hotel. Each family would have its own private rooms, the home which every woman likes to think of, but the preparation and cooking of food, the endless cleaning of crockery, utensils, cutlery, by the hand processes of to-day would be relegated to a central kitchen; whilst all washing and cleaning of linen, &c., would be carried out in a central laundry; where the nursing or care of children for such hours of the day as mothers want for leisure would be carried on in a central nursery; where also in a separate department sick children would be tended, avoiding the risk of infecting others. These ideas are not new, the rich to-day can enjoy these facilities. How can the average men and women enjoy them? My suggestion is that in every such block of homes the women who live there should do the work, but instead of working as isolated small units which cannot use power and appliances on an economic scale, they should all, for either part of each day, or for certain days of the week, put on appropriate clothing designed with an eye to purpose and to charm, leave the private home and entering the "factory" on the premises become the cook, the pantry maid, the laundry maid or the nurse, choice being by adjusting the hours in each pursuit, so that the relative attractiveness of the work and of the home would always provide a sufficient staff for each. In these circumstances power, electric power, and machinery could be applied to really do the work. I can picture these occupations carried on in clean, beautifully lighted, and well warmed properly ventilated and spacious apart-

ments, and if a costume approaching the modern American sun-bathing costume were adopted ultra-violet lamps in winter would do much to maintain the resistance against pathological germs, so terribly lacking in all classes in our climate under present conditions.

I am not a hotel keeper and so can only estimate what time each woman would spend on this mechanised housekeeping, but I believe that each woman need only work one-fifth of her time, that is less than 2 hours daily, or a day at the work once in five days. The home thus divested of its menial tasks and of the room devoted to them would have space saved, and the whole of this surplus space could be utilised in a more beautiful and comfortable manner. Such a block of homes, centrally warmed to a moderate extent, with electric radiators in each room, cleaned mechanically, again by the women tenants in their turns, would lift all families to a degree of comfort and civilisation that only the rich can now enjoy. Once given this freedom, women would desire, would contrive, and would get, a new style of living block. Not a square or cubical building with rows of small windows like the tenement blocks of London or Glasgow—but great buildings with fine frontages, great sweeping balconies, sun galleries all round to be open-air meal and living rooms in fine weather; places where children would play away from the streets in the open air and sunlight when fine, and protected from the weather, but still getting ultra-violet light from the sky through suitable glass, when the weather was inclement.

The communal house established in Prague by the Y.M.C.A. (fig. 4) expresses the ideas set out above and Erich Mendelsohn, the great Berlin architect, has shown how they can be carried out. An example of his work is illustrated in fig. 5.

Our E.A.W. could perhaps help to carry these ideas further. But would women adapt themselves to such a new life, with the discipline that it would necessitate? Or are they wedded by habit and convention to the older and present methods? Those of the past generation probably would not, but those of the present generation

**Fig. 5.—A block of dwellings in the Cicerostrasse, Berlin. Architect: Erich Mendelsohn.**

I am sure would be ready for the change if shown how to effect it. They have pronounced domestic work to be degrading; they are perhaps right—degrading because in an age when the possibility of rationalising the processes of feeding and housing and rearing families exists, scarcely any step has been taken to move from the processes of the savage and the peasant.

Look at the picture which heads these lines (fig. 1) and look at the next picture, the daily scene in nearly every home (fig. 2). Which is the pleasanter? At least the first is in the sun and air, and the body beautiful is better to look upon than the work-soiled garment of the woman of the "civilised" race. Look upon the third sketch (fig. 3); it is only an idea of how with a minimum of clothing restraint, leaving part of the body free to absorb health-giving radiation, our modern work might be *directed*, whilst *Power*, electric power, with suitable machines *does the work*. I could expand this idea if space permitted. Such dwellings must come; in suburban areas, cheapness of land would permit them of one or two stories, with roof gardens, and with spacious central courts beautified as gardens, tended by the women who would take their share of the work in this way instead of indoors. I could speak of the common rooms, of games rooms, and libraries, and of the other amenities which such a mode of life would permit, but let me end by urging our E.A.W. to think ahead, and to plan for a great objective, and so not only solve the servant question, but remove for ever the idea of servitude being associated with a home. Such a theme would form the subject for a play by a woman dramatist and actresses, and would exemplify "'Watts' in a Home," in a manner that would interest and appeal to a wide public outside of electrical circles.

# The E.A.W.

## A Welcome to Members Attending the Convention.

**By ALD. ALICE HUDSON (Deputy-Mayor of Eastbourne).**

I HOPE these few words will be a preliminary introduction to many members of the Electrical Association for Women whose acquaintance I may have the pleasure of making at the Annual Convention of the I.M.E.A. in Eastbourne. Eastbourne looks its best at the end of May—trees border the streets to an extent not often found in seaside resorts, while the three parades also make a somewhat unique impression with their carpet gardens and banks of flowering shrubs and plants.

Then, of course, delegates to the Convention will be interested in the very thriving electricity undertaking of the Corporation, an undertaking which is going ahead by leaps and bounds under the very able direction of this year's President of the I.M.E.A., Mr. J. K. Brydges, whose expert knowledge is doubtless too well known to need any elaboration from me. But Eastbourne owes him a debt of gratitude for all he has done, not only in bringing the electricity undertaking to its present state of high efficiency, but for the foresight which frequently, in various ways, has saved the ratepayers' pockets.

The citizens of Eastbourne are more and more realising the advantages of a full use of electricity, and in a town where women largely outnumber men it would be surprising to find it otherwise. For is not electricity in the home synonymous with labour-saving, cleanliness, and economy, surely all attributes dear to the heart and hand of each of those who have to run homes, whether large or small? Members of the Electrical Association for Women will consequently find in our town much to interest and to attract, and, if only the clerk of the weather is in his most radiant mood, I venture to think that they will say "au revoir" and not "good-bye" when their visit is over.

Elliott & Fry, London.

# Electricity Supply Employés.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.,
*Barrister-at-Law.*

*The author discusses the question of status as affected by contractual relations and legislative enactments.*

WHILST electricity supply employés do not differ very materially as regards their status from employés in other industries there are some features which distinguish them, mainly in respect of certain privileges and obligations attaching to their employment which arise in some cases by virtue of agreements which have been entered into, and in others as a result of legislation. These features relate to :—

(1) The contract of service and the responsibilities arising therefrom, both contractual and legal.

(2) The method of regulation of their remuneration and conditions of employment.

(3) The rights which accrue when changes are brought about in the industry as a result of legislation.

(4) Professional; this relates particularly to those who are members of the technical staff.

## Contract of Service.

The relationship of employer and employé arises out of a contract which may be verbal or written. In the majority of cases, particularly in regard to the technical staff, the contract will be a written contract and will provide for the termination of it by reasonable notice. Once a contract has been entered into, certain rights and duties devolve upon both parties depending on the terms of contract. In some cases, and this applies to electricity supply, when the relationship has once been created certain rights and duties arise which depend upon statute. There are certain features which are common to all contracts of service which may be noted. The duties of an employé to his employer during his service must, generally speaking, depend in a great measure upon the nature of his employment and the contract he has entered into. There are, however, certain duties which are implied by law from the relationship which exists and these are binding on all employés. Every employé, for example, is bound to obey all the lawful orders of his master. This does not mean that he is bound to obey every order but only those which are lawful and which come within the scope of the contract.

Every employé is also bound to be honest and diligent and not to abuse his employer's confidence in matters appertaining to his service. If an employé, unknown to his employer, in doing business with another takes from that other person a profit arising out of the business which he is employed to transact, he is doing a wrongful act inconsistent with his duty towards his employer.

Certain corrupt transactions in relation to an employer's affairs in business are made a criminal offence by the Prevention of Corruption Act, 1906, and by a subsequent Act of 1916 increased penalties are provided when the corrupt transaction was with a government department or a public body.

Every employé is bound to take due and proper care of the property which his employer has entrusted to him, and, if he is guilty of negligence and his master's property is thereby injured, he will be liable to an action, but he is not obliged to preserve it at all risks.

In the absence of any definite agreement and of any custom the contract of service will be terminable by reasonable notice. In the electricity supply industry the notice required to terminate a contract of service has become practically uniform. In regard to the technical staff one month's notice is required, and in the case of the operative staff seven days. This notice is the outcome of the agreements which have been entered into by virtue of the acceptance by employers and employed of the schedules formulated by the National Joint Board and the National Joint Industrial Council. Where an employé is under no definite agreement in regard to notice because of the non-application of the schedules, the notice would be that customary in the industry.

The desirability of a reasonable amount of notice being required is obvious where an important public service is involved. Under Section 4 of the Conspiracy and Protection of Property Act of 1875, it is an offence for a person employed in the supply of electricity to break his contract of service. A similar provision applicable to all public authorities is now contained in the Trade Disputes Act of 1926.

An employé can render his employer liable for contracts which he has entered into when acting within the scope of his authority. In the supply industry members of the technical staff who hold executive positions may be regarded as the agents for the undertaking and any contracts which they enter into on behalf of their undertaking, and coming within the scope of their employment, are binding upon the undertaking. An employé can also render his employer liable for his wrongful acts if those acts are done in the course of his employment and in the employer's service. The general principle is that with few limitations an employer is civilly responsible to third persons for any act done by his employé, provided it be done in the course of his employment, whether the act be one of omission or commission, whether negligent or fraudulent, and even if it be done in violation of the employer's orders.

Whilst an employer has the right to dismiss an employé for some misconduct and offer to re-employ him after an interval, he has no right to treat the contract of service as continuing and to suspend him without wages for a particular period; also the relationship of employer

and employé is not terminated merely because the latter is temporarily absent from work due to sickness unless there is some agreement to the contrary. This is important in connection with payment during absence from duty on account of illness. The position at Common Law is that an employé remains entitled to salary during any period of temporary incapacity in the absence of any term in the contract of service to the contrary. Many electricity undertakers have definite regulations in force providing for the payment of salary during absence due to sickness for periods varying with years of service. Where no such regulations exist, however, an authority is only entitled to discontinue payment of salary on giving proper notice, which in the case of technical engineers would usually be one month. The same would apply even though the employé was temporarily absent from work and in receipt of compensation for incapacity under the Workmen's Compensation Acts.

It may be said in passing that the position in regard to sick leave in the electricity supply industry at the present moment is very unsatisfactory owing to the lack of uniformity which exists. The first schedule of the National Joint Board for technical engineers contained definite sick leave conditions based on years of service, but they were excluded from the revised schedule of 1923, and undertakings are now allowed to make their own arrangements. Some of these are far from adequate and in some cases no regulations exist at all, with the result that many employés are uncertain as to what their rights are when they are absent from duty on account of illness. It is worth noticing in their case that they are entitled to have their salary continued until proper notice has expired. An undertaking is not entitled to stop payment of salary at a day's notice or a week's notice, if the notice terminating employment for the particular employé is one month.

Electricity supply employés, particularly those who are authorised persons, have special responsibilities arising out of statute in regard to the safe working and protection of electrical plant and apparatus, and in avoiding danger both to their fellow employés and others. There have been several cases recently where electricity undertakers have been fined because of their failure, or the failure of their employés, to take the necessary precautions. It should be noted that the responsibility for the observance of the Electricity Regulations is not confined to the undertaker. All persons who are engaged in electrical work to which the regulations apply, and who fail to comply with them, are liable to be prosecuted and fined. Thus, if an undertaker has provided the necessary means of compliance as regards any requirement of the regulations, and the employé fails to make use of those means, he becomes liable, whether an accident results from his neglect or not. Employés ought therefore to make themselves acquainted with these regulations and to conform to them. There is always a tendency for employés to take risks in the conduct of their work, and it is in order to prevent carelessness, or that familiarity which breeds contempt, that the regulations have been framed.

### Remuneration and Conditions of Employment.

The electricity supply industry is fortunate in possessing machinery for regulating the wages, salaries, and conditions of employment which is probably second to none in the country. Other industries have similar machinery, but it is doubtful whether any of them work more smoothly. The Industrial Council system in the supply industry has the merit of being flexible, and yet capable of maintaining the best possible relations between employers and employed. It is unique also, in that there is special provision for dealing with the technical staff.

The Councils differ in their composition from the Trade Boards in that the chairman is selected from one side or the other, instead of being an independent person. Whilst this arrangement has the merit that the Councils feel that they are conducting their business without any outside interference, it suffers from the disadvantage that it is difficult for the chairman to be completely impartial and there is a tendency for him to become spokesman for his own side. The Councils have now been functioning more than a decade, and their success has rested largely on the compactness and efficiency of organisation on both sides and the recognition that the industry is one of the most important and vital in the country, and therefore one in which disputes ought not to be embarked upon lightly. Only one improvement remains to be effected, namely, the appointment of a full time staff which shall be capable of dealing not only with the ordinary routine work of the Boards and Councils but of preparing statistics, preserving records, &c.

During their existence the Councils and Boards have built up what may be in fact regarded to some extent as a body of case law, and the proper preservation of their decisions necessitates the employment of someone who can give his whole time to the work. The Councils have displayed their greatest usefulness in acting as Courts of Appeal when differences have arisen between employés and the undertakers. Not only have they settled disputes by giving actual decisions, but their very existence has been the means of inducing settlements. The machinery has the merit of being complete from the bottom to the top, that is from the initial stage when a difference arises between an employé and an electricity supply authority, to the final Court of Appeal, which is the Industrial Court. So efficient has the machinery proved, however, and so friendly has the spirit between both sides been maintained that in only a few cases has it been necessary to resort to the final Court.

### Effects of Legislation.

The electricity supply industry has been subjected during recent years to a series of enactments which not only determine the manner in which the industry shall be carried on but also affect the employés engaged in it at numerous points. Interference by the State usually carries with it an obligation on the part of the State to compensate those who are adversely affected by its enactments. Electricity supply is no exception, and the question of compensation has become exceedingly important to employés engaged in it because they now possess certain rights when changes affecting their employment are brought about by the operation of the Electricity Supply Acts. These rights have already been discussed in these columns and they need not be further explained now. Only one matter may be noticed, namely, the deletion by an Act of 1928 of the qualifying date, May 8th, 1919, from the Act of 1919, thus bringing that Act into line with the 1926 Act and abolishing the disability in regard to compensation under which employés entering the industry after that date suffered. During the last twelve months several claims for compensation for loss of office have been settled, but not so many as one might have expected. Whilst the Central Electricity Board has undoubtedly made rapid strides in the construction of the "Grid," it has not yet reached the stage at which it is in a position to supply many undertakings with energy so as to enable the latter to shut down their stations. There is no doubt that, as more cases are dealt with, it will be possible to draw more definite conclusions as to the circumstances which satisfy the Commissioners and the referee that compensation is payable, and also to form a general idea as to the basis upon which the amounts of compensation are determined.

So far as the amounts of compensation which have been awarded are concerned they vary very considerably, but they indicate that, in some cases at least, the undertakers take a reasonable view of their responsibilities towards their employés. Several interesting problems are likely to arise as a result of the operations of the Central Electricity Board, particularly in regard to their method of operating generating stations. Whilst many stations will be closed down, it is certain that for long periods others will have to act as standby stations and will be kept either in operation or available for operation during certain parts of the year and certain parts of the day. Some will be base-load stations, some will be two-shift, and others one shift stations. The employés who are definitely dispensed with from these

stations will have their rights fairly clearly defined, but there may be others who will be adversely affected in a way not contemplated by the Act. The compensation rights of men who accept temporary posts in a station which is scheduled to be closed down are also likely to be the subject of consideration. There is an idea abroad that, if a post is advertised as being temporary and an engineer accepts it on that understanding, he relieves the undertaking from all liability in regard to the payment of compensation. It is very questionable whether any agreement relieving an undertaking from its statutory obligations would be enforceable. The fact that a man has accepted a temporary post may influence the mind of the referee when determining the quantum of compensation, but it is doubtful whether it will relieve the undertaker entirely from responsibility.

### Professional.

As regards the general status of technical engineers employed in the electricity supply industry the advent of standard rates of pay has fostered a growing disposition on the part of electricity authorities to insist on a high standard of qualification. Associate membership of the Institution of Electrical Engineers is now almost obligatory in the case of candidates for the higher positions. Some undertakings have gone so far as to make it a practice to limit promotion beyond a certain grade to those who possess this qualification. Others offer definite inducements in the shape of monetary advances to those of their staff who are successful in passing the qualifying examination. All this is tending to make associate membership a professional distinction, and not merely an academic one, and cause it to be regarded as a genuine hall mark of professional competency. There is still a good distance to travel before engineering is on a proper professional basis, analogous to that of law and medicine, but it is gratifying to know that progress during recent years has been in the right direction.

It is worth mentioning that in Queensland an Act has recently been passed which provides for the institution of a Professional Register for engineers, inclusion in which carries with it a statutory hall mark of engineering competency. A Board of professional engineers is to be set up under the Act, which to a large extent will control the engineering profession as far as its relations with the general public are concerned. Incidentally, associate membership of the Institution of Electrical Engineers is accepted as evidence of competency.

There is one disability under which technical engineers in the supply industry in common with staff employés in other industries suffer, namely in regard to their rights under the Workmen's Compensation Acts. Manual workers whose wages do not exceed £350 per annum are covered by the Acts, and there does not seem to be any logical reason why men in receipt of higher salaries should not have similar protection. Practically all technical engineers occupying positions as shift engineers, station superintendents, mains engineers, &c., are by virtue of their employment exposed to risks which may easily involve them in serious accidents which may permanently or temporarily disable them, and it seems anomalous that they should have no protection beyond what is given to them under the Common Law or the Employers' Liability Act. Efforts have been made recently to draft bills to amend the Workmen's Compensation Acts so as to bring within their scope employés who are receiving higher salaries than £350 per annum. Such a change is long overdue and would be welcomed by technical engineers.

# Staff Engineers and Supply Developments.

*Elliott & Fry, London.*

By W. ARTHUR JONES, A.M.I.E.E.
*General Secretary, Electrical Power Engineers' Association.*

*The author deals with matters concerning the personnel of electricity undertakings as affected by the post-war developments of the industry.*

MANY of the possible results of recent developments in the electricity supply industry having been foreseen by organisations like the E.P.E.A., steps have been taken to ensure machinery whereby any adverse effects upon particular employés may be reduced to a minimum, and an illustration of such machinery is afforded by the Compensation Clauses of the Electricity Supply Acts. Despite these provisions, however, experience of the effects of the changes and developments in question indicates the necessity for additional consideration being given to the position of those employés who may lose their employment as a result of the operations of the Central Electricity Board or any of the Electricity Supply Acts. Granted that the Electrical Power Engineers' Association as a consequence of its vigilance with regard to this matter from 1919 onwards has been able to secure a certain measure of protection by the insertion of suitable compensation clauses in the many electrical statutes which have been enacted during the past few years, there still, however, remains the fact that the primary concern of engineers who may lose their employment owing to any of the circumstances referred to, is to secure fresh employment rather than financial compensation. This aspect of the matter was discussed by the National Joint Board some two years ago, and as a result of its deliberations, a Displacement Committee with subsidiary Area Displacement Committees were suggested and in some cases set up. One notes with some regret, however, that the work of these Committees has, up to the moment, had little, if any, tangible result. It must be admitted that the

problem of finding employment for an engineer who may have had some 20 or 30 years' service in the industry and be bordering on or over 50 years of age, is one not easily capable of solution. At the same time, there would appear to be both amongst the undertakings and the employés likely to be concerned a lack of appreciation of the gravity of the problem. Nor is the position restricted to men of long service or of advanced middle age. In these days, the position of a charge engineer, for example, has a tendency to become a career rather than a stepping stone to a higher position, and of the number of charge engineers in the country, the percentage likely to receive or secure promotion to higher posts must, of necessity, be very small. The engineer who may have had some 10 or 15 years' service in the industry and at, say, 35 years of age loses his employment as a result of the operation of the Supply Acts, provides a case which requires not only possible financial compensation to cover temporary hardship, but certainly a large measure of practical help towards securing fresh employment, either of a specialised character suitable to his training and experience or in another section of the industry where his ability and qualifications would be of value. One does not overlook the responsibilities of the individual in respect of matters of this kind, and the purpose of the present observations is not to suggest a species of spoon-feeding for such engineers, but rather to hope that the needs of the situation will be recognised by the industry generally, and that practical assistance may be given to such engineers not only when the occasion actually arises, but for some months prior to its eventuality. The Association, as a technical organisation, is doing its best to render assistance of the kind needed, especially by the provision and dissemination of technical information amongst the members of the Association, and, further, as between its members and engineers engaged in other sections of the electrical industry. As an illustration of this, I need only refer to the Technical Group Scheme of the Association which has now been in existence for some two years and has functioned with much success, particularly in London, Manchester, and Birmingham. This Technical Group Scheme, however, has in the main been devised in the interest of securing an improved standard of efficiency amongst all the engineers concerned, rather than to cater for the particular difficulty now under discussion, although at the same time the scheme will undoubtedly contribute its quota of effort towards the solution of this problem. For its ultimate satisfactory solution, the need is for the wholehearted and sympathetic co-operation of the various undertakings in the provision of facilities to enable generation engineers to acquire knowledge and experience of other departments of the undertaking in anticipation of, and preparation for, the time when their particular stations are closed down.

### Municipal Superannuation.

A further question to which reference may be made relates to certain aspects of the operation of various Municipal Superannuation Acts of which the standard example is the Local Government and Other Officers Superannuation Act, 1922. Engineers, in common with the rest of humanity, are subject to the effects of "Anno Domini," and the members of the E.P.E.A. are just as interested in the possibilities of old age and the necessity of suitable provision therefor as any other section of the community. Some members are engaged in undertakings, both municipal and company, where superannuation or life assurance schemes are in operation, and there has certainly been during the past few years—particularly amongst company undertakings—a marked increase in the number of such schemes. The extension in the number of self-contained schemes of this character is gradually bringing the question of superannuation to a position and state of affairs that is almost verging on the chaotic, an aspect which is dealt with later on in this article. A large number of municipalities—probably the majority—have superannuation schemes in operation, some of these under their own particular Acts, but the greater number under the Local Government and Other Officers Superannuation Act, 1922. In connection with some of these schemes, however, the operation has been limited to "officers on the staff" of the particular Council, and the result has been to exclude all below heads of departments in respect of the technical staff of the electricity undertaking. It is not suggested that this particular type of action is deliberate, but it arises apparently from a failure to realise the existence of any officer in an electricity department other than a chief engineer and heads of departments. Is it a sign of lack of education amongst civic dignitaries that they should consider an office junior at the Town Hall to be an "officer" of the Council, whilst the charge engineer of possibly two or three times the status and salary, to say nothing of length of service, is something between a workman and an officer? There are several municipalities to our knowledge which have instituted a superannuation scheme for the officers of the Council and included therein the junior clerk at the Town Hall, but excluded the charge engineer at the electricity works.

May one hope that at the forthcoming I.M.E.A. Conference some regard will be paid to this aspect of the administration of the average municipal electricity undertaking, which, in these days, is such an ornament to the parish pump, and that the subordinate officers, as well as the chief officers of that department, may be considered to be equal in status to the clerical staff?

### Company Pension Schemes.

Dealing with the other section of the industry, may one refer to the various superannuation, pension, and similar schemes which company undertakings have put into operation? Attention might be called to one effect of these independent and self-contained schemes which may act detrimentally on the industry in the near future. Possibly, from the point of view of a particular company, it is an advantage for it to capture the engineer comparatively young and train him in the ways and methods of the company and supplement this by a special superannuation or pension scheme so as to ensure reluctance on his part to leave the staff of this company. Is it, however, in the interests of the industry to create artificial restrictions to the free movement of engineers amongst the electricity supply undertakings of the country? Undoubtedly a tendency of this kind is one of the effects of a multitude of independent schemes.

It will be remembered that so far as schemes under the Local Government and Other Officers Superannuation Act, 1922, are concerned, an employé contributing to a scheme under that Act and moving from one local authority to another, both of whom have the Act in operation, carries with him a transfer value in respect of his superannuation rights. A need for some centralisation and co-ordination of the various schemes which have been instituted by company undertakings is obviously indicated, so as to secure that an engineer moving from one company to another, or from a company to a municipality, or *vice versa*, should be able to carry with him the transfer value of his rights to superannuation. One naturally is aware that under most of these schemes, and on ceasing employment with a particular company under ordinary circumstances, the contributor does become entitled to the return of the contributions which he has paid, and in some cases with compound interest added thereto. But it has to be borne in mind that the value of superannuation rights is one thing, and the return of contributions, even with added interest, may be another. Obviously, the longer the period of service of an employé, the greater the disparity between the value of superannuation rights and the return of contributions paid.

Some two years ago, the E.P.E.A., actuated by a desire to make comprehensive superannuation scheme arrangements for its members on the staffs of electricity supply companies, formulated a superannuation scheme based on the Local Government and Other Officers Superannuation Act, 1922, which was submitted to certain of the companies for consideration. From the point of view of securing one comprehensive company scheme, it is regrettable that the E.P.E.A. proposals did not receive the support and consideration that they deserved,

and since then several schemes have been introduced by different companies, each of them independent and bearing their particular characteristics, including the special detriment to which reference has been made.

The desirability of securing uniformity amongst the various superannuation and pension schemes has already been recognised in official quarters. Recently the London and Home Counties Joint Electricity Authority had under consideration the various pension schemes of the London Companies, and in a communication addressed to the Authority, the Electricity Commissioners pointed out: "As the schemes on which the Authority's observations had been sought varied, and the Commissioners considered that it would be the wish of the Authority, the superannuation conditions of employés . . . should so far as possible be uniform, they had for the time being withheld their approval to the schemes as submitted, the intention being to endeavour to obtain such amendments as will secure uniformity of pensions and allowances."

It is not always appreciated that the Local Government and Other Officers Superannuation Act, 1922, to which we have previously referred, can be made applicable to officers and servants of an electricity supply company in a particular area. There are two methods by which this can be done. Firstly, by the particular company in framing its superannuation or pension scheme taking the 1922 Act as the model or basis of any such scheme, and, secondly, seeking by virtue of Section 5 (3) (*b*) of the 1922 Act, admission to the schemes of local authorities operating that Act. The section referred to allows such a local authority to include within its superannuation scheme any of the officers or servants of any undertakers exercising any of their powers within the area of the local authority.

Another important factor in connection with this problem arises from the powers of the Joint Electricity Authorities. It will be remembered that under the Electricity (Supply) Act, 1926 (Sec. 33), the Central Electricity Board or any Joint Electricity Authority may, if they think fit, adopt the provisions of the Local Government and Other Officers Superannuation Act, 1922, as if they were a local authority within the meaning of that Act.

It may also be pointed out that any Joint Electricity Authority which did adopt the 1922 Act would have the powers conferred by Section 5 (3) (*b*) referred to, and thereby could include within any superannuation scheme that it might adopt the officers or servants of the undertakers within their area.

At a period like the present, when there has been amongst electricity undertakings—both municipal and company—such a general adoption of superannuation or similar schemes, the time would appear to be ripe for strenuous steps to be taken for securing a large measure of uniformity and co-ordination amongst these schemes, and the powers conferred upon Joint Electricity Authorities would seem to indicate the means whereby such uniformity could be obtained.

### Switchboard Attendants.

A problem which is likely to become acute in the near future is the question of demarcation between the technical staff and the operative staff, particularly those employed on switchboards. It is well known that the switchboard is to some extent a graduating place for higher positions. Young men, who have received a sound technical training and who are hoping ultimately to obtain positions in the higher ranks of the technical staff, spend some time on the switchboard acquiring experience. Whilst in that position, however, they have a strong dislike to being treated as operative staff and prefer to regard themselves as junior engineers. At the same time, it is an undisputed fact that many switchboards are manned by attendants of the ordinary type who have little prospects of ever securing a position on the technical staff because of their lack of technical training. The former are usually members of the Technical Staff Association, whilst the latter are generally in the Operative Unions. Attempts have often been made by the Operative Unions to insist that all switchboard attendants should be dealt with by the Industrial Councils. This, however, is a claim which even the employers have been unwilling to concede, as they recognise that many switchboards are manned by technical engineers. The development of the industry is also bringing about a change of attitude on this question. It is now being recognised that the supervision of a switchboard in a large station, particularly where load control between stations is involved, or the supervisory control of sub-stations, demands a greater degree of technical knowledge than the ordinary operative type of employé possesses, and it is necessary to engage junior engineers who are paid on the technical staff. Many undertakings have already adopted the practice of employing junior engineers, and it is more than probable that in the future this practice will become general.

### Schedule of Salaries.

Of the matters in which the technical staff engineer in the supply industry is interested at the moment, doubtless that of special interest is the revision of the schedule and conditions of the National Joint Board which is now under consideration. The present is obviously neither the time nor place to discuss in detail the proposals which have been submitted by the two sides of the Board. At the same time, and possibly without offending any of the canons of etiquette or good taste, some observations on the general position may be indulged in.

It will be remembered that the National Joint Board was formed in May, 1920, and its first piece of work was to approve a schedule of salaries and conditions of employment for the technical staffs in the electricity supply industry. The negotiations for such a schedule had been in progress for some months previous, and the formation of the Board and the agreement upon its schedule were practically simultaneous.

In 1923, a revision of the schedule was undertaken and certain amendments and additions were made. These, however, were comparatively minor in character, and little or no alteration was made to the general principle underlying the schedule. During the past five or six years, however, developments in the industry have been such as to render the present schedule somewhat obsolete and inappropriate as a means for dealing in an equitable fashion with such conditions, insofar as they affect the technical staffs of the industry. It was because of this that the E.P.E.A. some time ago decided that the time had arrived when a new schedule was an imperative necessity, and after investigation and consideration extending over some 12 months, it formulated a schedule and conditions of employment which was presented to the employers' side of the National Joint Board in January, 1929. Some two months ago, and after close consideration of the proposals submitted by the E.P.E.A., the employers' side of the Board submitted its counter proposals. As before remarked, it would be unwise to discuss either the original proposals of the Association or the counter proposals of the employers, yet one may be pardoned for expressing a regret that in their counter proposals the employers as a body have apparently failed to appreciate at their proper value the changes which have taken place during the past few years, and will probably continue to take place in possibly a more accentuated form, in the future. The Association in its proposals had made strenuous endeavours to cater not only for the changes which had taken place, but also for the possibilties which are likely to arise. The employers' proposals in the main would appear to be the 1923 schedule with a few minor alterations and one drastic one. It may be that the Association as a body of engineers engaged in a particular task, visualised the problem before it, overmuch from an engineers' point of view, but even so, might it be suggested that the employers' proposals have a lack of engineering characteristics which render them hardly suitable to the present and future development of the supply industry.

# The Hebburn Short-circuit Testing Plant.

*Jas. Bacon & Sons.*

By H. W. CLOTHIER,
Assoc.M.Inst.C.E., M.I.E.E.

FOR many years the need has been repeatedly expressed for plant in Great Britain with which the heavy short-circuit conditions experienced in practice on electricity supply networks could be reproduced under accurate control and scientific measurement, and reports already published of the details of such plants on the Continent and in America have made the demand more insistent. The question has frequently been asked: "How do you know the breaking capacity of your circuit-breakers?" and the reply has had to be: "From the results of tests on the smaller sizes made with such plant as supply authorities have been able to put at our disposal; from short-circuit tests of makers' normal machines on the test bed; and more particularly from the accumulated data of accidental short circuits on plant and networks in practice." The last are of great value, since there are systems with 200,000 or 300,000 kilowatts available; but even so, a post-mortem of a circuit-breaker, although it may lead to an improvement in the next design, is never really conclusive, because the performance record does not include accurate measurement of all the factors that have culminated in the actual result.

A great deal of information has been obtained from the excellent research work done by the British Electrical and Allied Industries Research Association under the direction of Mr. E. B. Wedmore and his assistant, Dr. Whitney. The work had to be done, however, on a 6,000-kW alternator, and the maximum short circuits available were not large enough to give a full-rating test on a normal high-voltage sub-station oil-immersed circuit-breaker. Many fundamental points were investigated and some criticisms of existing switchgear theory and practice were made; and, in addition, new methods were developed, up to a size limited by the power available. These have again intensified the call for larger plant with which the conclusions arrived at can be confirmed or corrected.

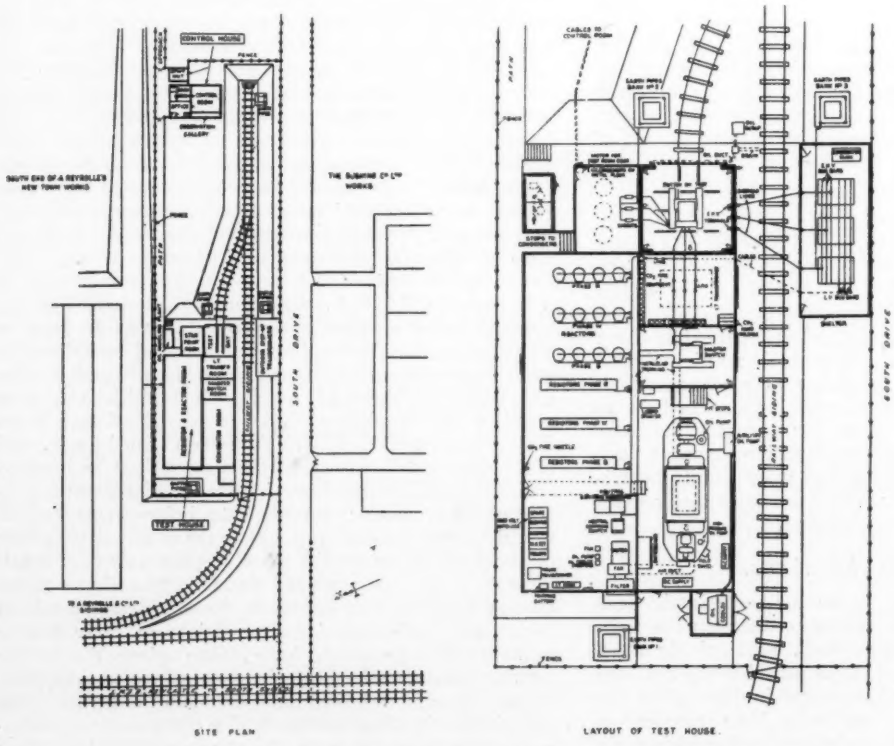


**Fig. 1.—General Layout of Short-circuit Testing Plant.**

Several co-operative schemes for such plant have been suggested, but one after another have fallen through. These disappointments led the writer to recommend his Company to take independent action twelve months ago. Plans were studied, and the available experience in the details and layout of instruments was investigated, including that of the B.E.A.I.R.A plant at Carville. The personal interest of Sir Charles Parsons, and the active co-operation of his Company in the development of the design of the alternator and transformers, subsequently built by

it, were naturally of great advantage. At one time the possibility was considered of having two relatively small alternators as the ultimate plant, but after exhaustive examination of the problem from every point

**Fig. 2.—Extinguishing Oil Fire with Portable $CO_2$ Equipment.**

of view it was decided to build a single plant having the required short-circuit capacity of 1,500,000 kVA, which is generally accepted as the largest capacity for which supply undertakings will lay out their plant in Great Britain. As a result, an adequate British testing station is a reality to-day. The plant is situated in Reyrolle's New Town Works, and is conveniently accessible from the L.N.E.R. line between Newcastle and South Shields. Fig. 1 is a diagrammatic plan showing the general layout, including the railway siding and lines provided for the transport of apparatus under test.

Among the objects in view during the design of the plant have been :—

(1) The safety of operators.

(2) The safety of plant.

(3) The selection and layout of measuring and automatic recording devices so as to produce records of the highest degree of accuracy and completeness in a permanent form.

(4) The design and disposal of components of a given size so as to obtain the maximum effective output.

For these purposes the Control House is completely separated from the plant and Test Bay by a distance of 50 yards, but a full view of all that happens in the Test Bay is obtainable from a gallery in the Control House, through slits in a concrete wall (fig. 5). All the plant is under complete control from the Control House, so that the Test House (shown in fig. 3), and the railed-off enclosure in which it stands, may be clear of personnel, and the Test House itself locked up, during tests. All circuit-breakers and bus-bars are of the standard metal-clad type in order to keep the plant safe from fire risks and from electromechanical distortion, and, further, the safety of operators is doubly secured by a complete system of interlocking, under which the alternator cannot be excited unless all doors are locked.

The alternator is protected by means of a Merz-Price current-balance protective system, which opens the field circuit and the main incoming supply switch controlling the motor. Definite time-limit protection of the over-current type is provided also to open the field circuit of the alternator in the event of a short circuit between the machine and the load during running up and excitation. The timing is adjusted so that tripping occurs well before the machine is fully excited, and thus the effect of an accidental short circuit is kept sufficiently small.

To protect the motor and the supply system from the shock of the test short circuit, the 5,500-volt main supply is cut off automatically before the test circuit is subjected to a short circuit by the closing of the Master Switch, and the arrangement is such that the test circuit cannot be closed unless the main supply circuit is fully open. Conversely, as soon as the circuit is clear again after a test, the main supply switch is reclosed, so that the alternator is brought quickly up to speed again, in readiness for the next test.

Since the plant is designed to test apparatus to destruction, it has been necessary to contemplate the possibility of a large outbreak of fire, and in that event the whole Test Bay can be flooded in thirty seconds with $CO_2$ from cylinders stored in the Low-Voltage Transformer Room. The gas can be released either by remote electrical control from the Control House, or locally by remote or direct hand operation, and the local arrangements include means for flooding the machine and terminal pit with $CO_2$. Thermostat sentinels are provided to give audible warning of fire in the Master Switch Room. Small oil fires would be extinguished by portable $CO_2$ equipment, also fed from the main storage through a system of pipes and valves, and fig. 2 shows the hand fighting of such a small fire in the Test Bay.

As a test of the efficacy of the main fire-extinguishing apparatus, an oil-tank containing 120 gallons of switch oil was heated to 140 deg. C. and then ignited by means of wood and waste soaked in 18 gallons of petrol and paraffin. The tank was then upset, and after sufficient time had been allowed to elapse to ensure that the oil was well ablaze the Test Bay door was closed and the $CO_2$ was released by means of remote control from the Control House. The time that elapsed between the decision to close the door and the complete extinction of the fire was 15 seconds. After about 5 minutes the door was opened again, and the smoke and gas were allowed to dissipate.

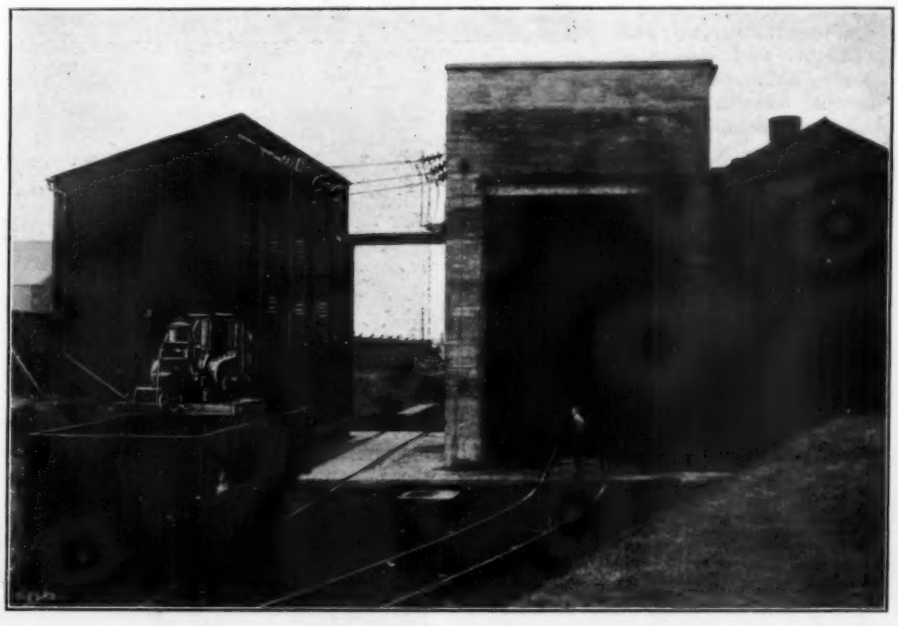

**Fig. 3.—Test Bay viewed from Control House.**

The damage done was negligible, and consisted only of a slight blackening of the lamp shades, control switches, and other apparatus in the Test Bay. The inspection also showed that the oil had run into the ducts and drains provided to assist its extinction and to allow it to escape, and had found its way, as desired, into the oil sump.

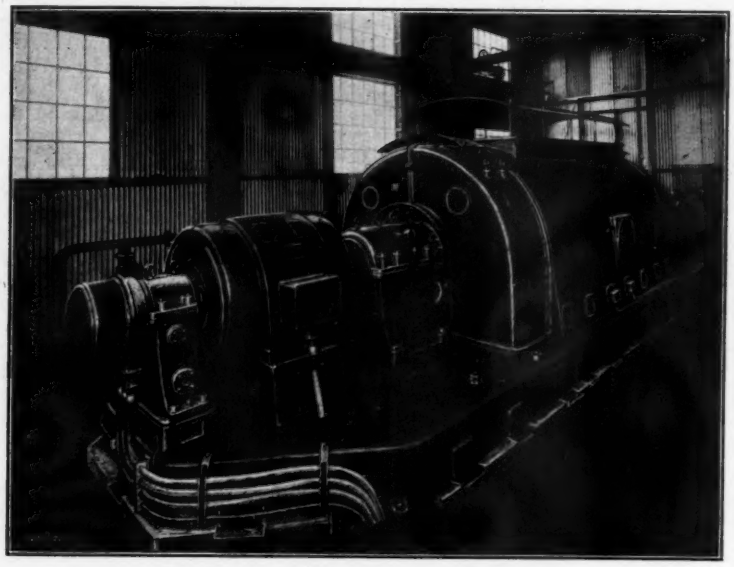

Fig. 4.—General View of Alternator Set.

Interesting questions arise about lubrication in a consideration of the safety of the plant. Unlike an ordinary power station, the whole plant is standing for periods, such as nights and week-ends, during which, particularly in cold weather, the viscosity of the oil changes to an unusual extent; means have therefore been provided to heat the oil, if necessary, before starting, as well as to cool it when running. The alternator is equipped with an electrically-driven pump for circulating the required 650 gallons of oil through the heaters and coolers and through the bearings, but, owing to the length of time, about half an hour, required by the machine in slowing down, it has been considered expedient to have a stand-by pump, driven by an independent petrol engine, for use in case the electrically-driven pump should fail. In order to give an indication of possible overheating, caused, for instance, by failure of the oil-circulating supply, each main bearing is fitted with a bi-metal spiral thermostat, which gives visual and audible alarms in the Control House, and a contact-making pressure-gauge is used to indicate directly any stoppage of the oil supply. A further important feature is concerned with the starting up of the alternator. At the instant of switching on the 5,500-volt supply to the driving motor, a hand-operated pump is used to force a film of oil under the shaft in each bearing, at a pressure of 1,000 lb. per sq. in. This raises the rotor and allows the motor to turn it easily; the advantage of the arrangement is that it obviates the use of a geared motor, such as is usually required to start so large a rotating mass.

Fig. 5.—Control House, showing Observation Slits.

One of the chief problems in the design of a plant of this exceptional type is the selection and layout of instruments, particularly to prevent misleading results, such as might be due to mutual interference between the main test circuits and the instrument circuits. The solution of this problem has been found in making one room in the Control House contain all measuring and recording instruments, which are thus sufficiently remote from the main conductors. As an additional precaution, all secondary leads for current consist of twin concentric cable, and all potential leads and instruments are screened by metal plates at places where they must approach the heavy-current circuits. The oscillograph is of the Ho and Koto electrostatic type, the potential being reduced by means of condensers, but electro-magnetic elements are provided for the simultaneous measurement of current and of other quantities, such as fluid pressure in switch tanks.

The timing and control of short circuits is effected through a series of contacts operated by a pendulum, to be seen in the background of fig. 6, and the process is initiated by the Engineer-in-charge. In the layout of the oscillograph equipment the experience of the Cambridge Instrument Co., which supplied the instruments, has been of service. There are three cameras, each with a self-contained optical system, and the set can take as many as nine oscillograph records of different events concurrently, in addition to other records produced mechanically on celluloid. Separate apparatus is also provided to measure fluid pressures by means of micro-indicators. The dark room contains novel features characteristic of the way in which every detail has been carefully thought out. For ex-

Fig. 6.—Oscillograph Room in Control House.

ample, special apparatus is provided for washing films, and there are warning signal lamps to guard against the opening of the camera hatch at inauspicious moments. The safe storage of records is ensured by the use of metal fireproof cabinets.

The testing unit, consisting of a motor-driven 3-phase alternator with a directly-coupled exciter, runs at 2,400 r.p.m., and is designed to give, on sudden short circuit, an output of 1,500,000 kVA. The motor is connected directly to the 5,500-volt supply mains, and the alternator gives its output at four voltages, namely, 22,000, 12,700, 11,000, and 6,350 volts, obtained by coupling the alternator windings in series-star, series-delta, parallel-star, and parallel-delta. The connections are changed by means of links in the terminal pit underneath the alternator frame.

Although the alternator has been designed mechanically as far as possible in accordance with standard high-speed practice, it has the special features of low reactance and maximum inertia, which are of first importance for its particular purpose. To secure the short-circuit decrement characteristic of a modern commercial machine, the solidly forged rotor is fitted with heavy damping-bars, which also serve to keep the internal losses in the alternator at a minimum, so that the maximum energy is available for external dissipation in the apparatus under test. One of the very important results of the special design of the alternator is that the energy stored in it as a single machine is equivalent to that which would be stored in a number of smaller machines in parallel, having the same total kVA output.

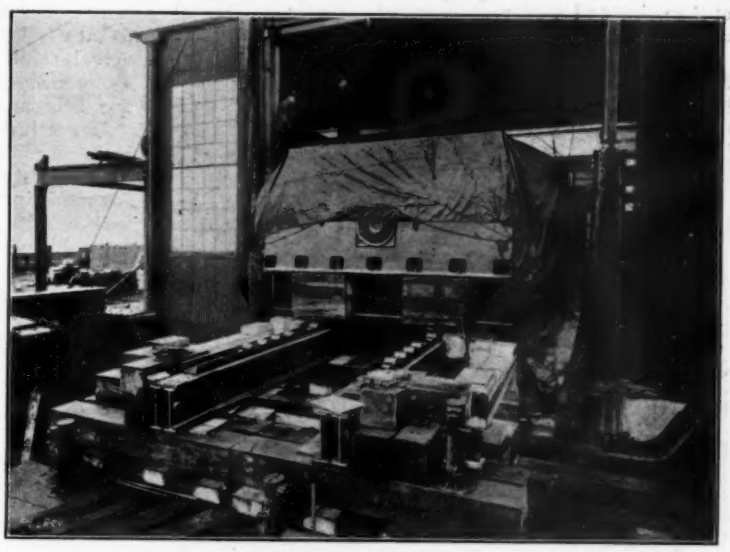

Fig. 8.—Unloading the Alternator Stator.

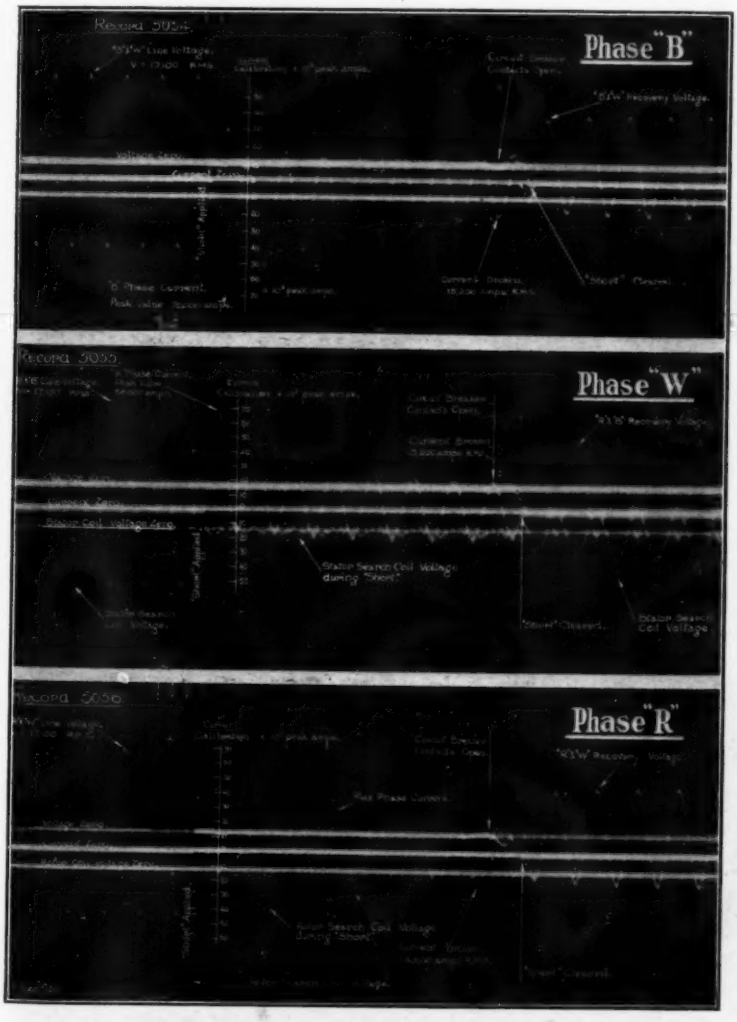


Fig. 7.—Oscillograph Record from Circuit-breaker under Test.

The alternator is of the turbo-type, with strongly-supported stator and rotor windings insulated throughout with mica. The stator casing and the bed-plate are built of welded mild-steel plates, by which a stronger construction is obtained than by the use of cast iron, and difficulties due to initial casting strains are avoided. The structure is sound and the danger of cracking under heavy forces is eliminated. The alternator, with its driving motor, its bed-plate, and other accessories, weighing in all about 120 tons, is mounted on a massive concrete foundation built on the Hennebique system, weighing approximately 250 tons; the whole set is securely anchored by a large number of holding-down bolts of exceptional length and strength. A view of the alternator stator being rolled into position from the special L.N.E.R. truck is given in fig. 8.

By means of a separately-driven fan, the air is drawn from outside the building through a viscous-type air-filter and discharged into the generator room after passing through the stator casing. Since the duration of the short circuits is very brief, the ventilation of the alternator core and windings is not of so much importance as usual, and the volume of the ventilating ducts is less than it would be in a commercial machine of the same overall dimensions. The space thus saved is used to provide an increased quantity of effective material, such as core laminations and copper, and has made possible the particularly solid and compact arrangement of the windings shown in fig. 9.

A bank of step-up transformers (fig. 10) allows the testing of complete three-phase circuit-breakers rated up to 66,000 volts, and of single-pole units of three-phase circuit-breakers rated up to 1,500,000 kVA at 132,000 volts. The bank consists of three single-phase units, designed with an unusually low reactance in order to obtain the maximum short-circuit current. On account of the heavy mechanical stresses to which the transformers will be subjected, shell-

type construction has been adopted, and the windings are secured against movement in any direction by heavy clamping.

The main current-carrying connections have a section of 3 sq. in. and a current-carrying capacity of 300,000 amperes for one second, and it will be seen from fig. 1

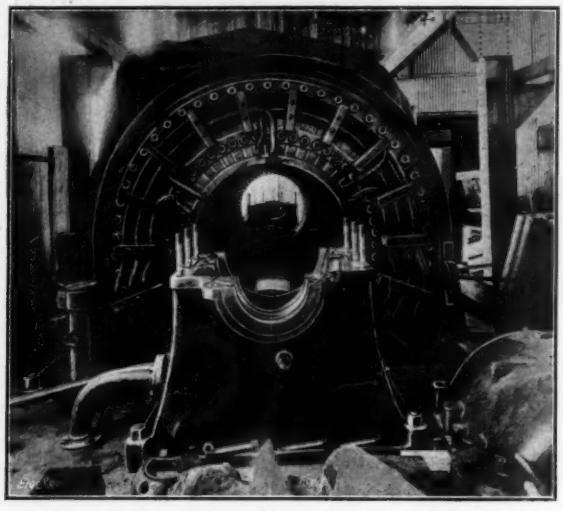

**Fig. 9.—Alternator Stator in Course of Erection.**

that they are disposed substantially in a straight line, which reduces the reactance of the test circuit to a minimum. Deviations from this straight-line path are made only when taking current through reactors or resistors in the adjoining bay with the object of limiting the short-circuit power and controlling the power-factor of the test circuit. Space is provided in the straight line for the addition of a step-down transformer for low-voltage current tests, such as those required to determine short-time ratings up to 5 seconds in accordance with British Standard Specifications. Incidentally, the demand for the short-circuit testing of flameproof apparatus has been met by the provision of a special box enclosure to contain methane or other explosive gases. Further incidental apparatus is a pumping plant and a filter for economy in the use and storage of oil. These, together with tanks capable of holding 1,200 gallons of clean and 1,200 gallons of dirty oil, are accommodated in an annexe separate from the main building.

The routine process of testing may be generally visualised as follows. The apparatus to be tested is conveyed in a railway truck to the Test Bay, and is there connected up to permanent terminals. All speed-recording, pressure-indicating, and other such devices are fitted, and all connections are checked over. The plant is run up to speed. Everyone leaves the areas prohibited during tests; the doors of the Test House are locked; and each person reports to the Engineer-in-charge in the Control House. The gates giving access to the enclosure containing the Test and Control Houses are locked, and the key is handed to the authorised person, namely, the Engineer-in-charge. The receipt of this key is the token that the test may begin. Observers stand by on the observation gallery, and an "authorised-person's" key is used to close a switch completing the protective interlock circuit. If all is safe according to plan, the alternator can be excited and regulated to the required voltage. The Master Control Switch is then freed, and by its closure the timing pendulum is set in motion, thus initiating the remaining train of events, which vary in sequence and in time according to the particular tests required. It is clear, of course, that it is not necessary to take the precaution of observing the results of every test from a distance; but since, as has already been mentioned, it is the intention that some tests shall be tests to destruction, it is safest, as a matter of routine, to take full precautions every time. An example of the actual result of a test is illustrated in fig. 7, which shows the record of a circuit-breaker making and breaking a three-phase short circuit.

In conclusion, an acknowledgment is due to those who have contributed to the design and supervision of this notable installation. It is an enterprise that has called for much initiative. An electric power-supply station, with infinite variety of load under complete and remote control, and designed to reproduce with economy the momentary outputs of our largest power stations, is no mean achievement, and in thanking all who have taken part special tribute must be paid to Mr. J. Rosen and Mr. W. D. Horsley, of Messrs. C. A. Parsons & Co., Ltd., and to Mr. B. H. Leeson, Mr. J. A. Harle, Mr. R. H. Brierly, and Mr. G. Hill, of Messrs. A. Reyrolle and Co., Ltd.

## Rural Area Transformers.

The Technical Committee of the French Association of Large Electrical Machinery Manufacturers has drawn up proposals for a series of standards in respect of transformers for rural electricity supply systems in France. The proposals, which are at present under consideration and subject to modification, provide that all transformers for such service shall bear a plate having on it the words "Transformateur Rural," its rural and C.E.I. ratings, and characteristics as stipulated by the French Union des Syndicats d'Electricité. The proposals will apply to three- and single-phase transformers of from 1 to 50-kVA capacity at 5,500, 11,000, 16,500, and 22,000 V.

The French Ministry of Public Works has lately issued modified regulations with regard to the requirements in transformer stations under which the minimum distance between h.p. apparatus is reduced, where the staff is protected from contact therewith by means of screens or other devices. In general, passages between machines and apparatus in open-air stations must have a height of at least 2 metres (6½ ft.), and a width of not less than 1 metre (39 in.). Where, however, a screen at least 6½ ft. high is fixed between the machines and the passage, the width of the latter may be reduced to 80 cm. (32 in ).

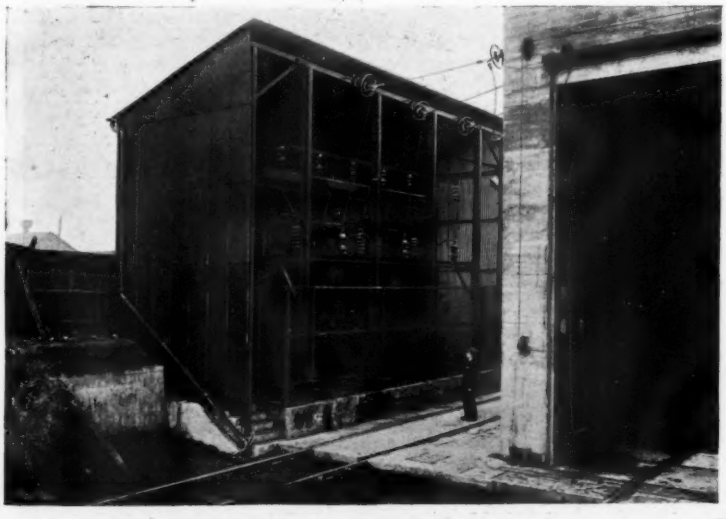

**Fig. 10.—The Bank of Step-up Transformers.**

# Electric Heating.

By W. Y. ANDERSON, M.I.E.E.

*Notes on the application of electricity to industrial and commercial heating, and some figures relating to the cost of operation of electric furnaces for various purposes.*

THERE is undoubtedly a very large potential electric heating load in this country. One authority has estimated it at ten times the total load of all kinds at present connected to the mains of the various public supply undertakings. It is difficult, of course, to make any accurate forecast, but a brief survey of the field will convince everyone engaged in the commercial development of electricity of the enormous possibilities which lie ahead.

Serious consideration has only recently been given to the question of the electric heating load by electrical engineers, but as progress, at ever-increasing ratios, will undoubtedly be made in the immediate future, it is necessary for a careful examination to be made of every use to which electricity can be put for heating purposes. The growing importance of this load is indicated by the space now given to the subject in the electrical Press, and, in this connection, it is desirable that full publicity should be given to heating installations, more especially those of a new character, for the benefit of all engaged in the industry.

One of the chief advantages electricity possesses over its rivals is its adaptability for all heating purposes, and it is the intention of the author of this short article to examine some of the avenues open for exploitation.

### Sundry Applications.

The use of electric water heaters and the conversion of existing hot-water systems by fitting immersion heaters in storage tanks to supply water for domestic purposes is now being developed on all sides. It is not, however, sufficiently realised that the fitting of electrical water heaters as auxiliaries to coke furnaces can often be usefully applied to business premises.

Blocks of flats are now being successfully supplied with hot water electrically heated. The cost of electricity may be higher than the actual cost of coke if supplies are obtained from a coke-fired boiler, but in the latter case the cost of fuel is only a portion of the overall cost. It is also necessary to consider the space required for the boiler house and fuel, distribution piping, labour and stoking, the possible nuisance caused by smoke and dust, and the other drawbacks. Against this the electrical system is flexible, and will meet demands promptly. A separate system can be installed for each block, thereby effecting economies, and the storage tank can be placed in the most convenient position.

The manifold uses of electricity for heating purposes in cafés has not hitherto been sufficiently exploited. The kitchen of many of these premises (often the café itself) is frequently situated in a basement or a confined room, where space is extremely valuable and where it is most desirable that there shall be perfect cleanliness and freedom from smell and fumes. Electricity is therefore the ideal method of heating, and an increase in running cost, if any, is more than compensated for by its many advantages. There are now many types of efficient electrical ranges, hot cupboards, and auxiliary appliances on the market, and good business could be done if electrical salesmen would have a litttle more confidence in their wares. Efficient and satisfactory water boilers can be recommended, a useful size having a main or boost load of 4 to 8 kW, and a byepass of .75 kW. During a rush hour approximately 100 pints of boiling water can be obtained for a consumption of 6 kWh.

The heating of churches also provides a useful field for development. In a suburban church in Birmingham with a tubular heating installation of approximately 45 kW, the number of kWh required for heating purposes for the year ended March, 1930, totalled 10,650.

There is good scope for electric heating in garages, which contractors should bear in mind when wiring premises. Much business is lost through contractors not pointing out the advantages of installing heating and power plugs when carrying out lighting installations.

The electric baking load is well worth cultivating. In working conditions it has been found that an electric oven will perform the same service as two side-flue ovens, as it can be used continuously in place of two ovens alternately. This increased output can be obtained with an existing staff, without the provision of a stoker. Better results are obtained owing to the more even control of the temperature, and everything is carried out under perfectly clean and hygienic conditions, so essential when food is concerned.

In Birmingham electricity is supplied to bakery ovens between the hours of 8 p.m. and 7 a.m. at 0.6d. per unit, and during the remainder of the day at ¾d. per unit, subject to the supply not being used between 3 p.m. and 6 p.m. in the winter months—October to January inclusive. This tariff is promoting a steadily growing baking load.

Electric heaters are particularly useful for printing machinery.

A special type of heater is needed by manufacturers of silver paper, &c. The machine consists of a number of rollers, between two of which the tin-foil and wax paper meet. The rollers are heated so as to melt the wax paper, and the tin-foil adheres to it. In the manufacture of rugs, &c., calenders have to be heated for process work, and installations have been successfully heated electrically. There is also a wide field for electrically-heated drying cupboards.

There is a steadily growing heating load in buildings which provide both office and workshop accommodation. In order that the tariff may be kept at a low figure, the load should, so far as is possible, vary inversely as the total demand on the generating station, such a load being ideal from the point of view of reducing generating costs. It is usually necessary, therefore, to restrict the load during the period of maximum demand. Every endeavour should also be made to create a steady load during the night, when the demand on the station is small and energy can be supplied at the cheapest rates.

### The Electrode Boiler.

In the case of large installations where supplies of high-voltage alternating current are available, electrical engineers are now giving their attention to the desirability of introducing apparatus constructed on the electrode-boiler and thermal-storage systems.

An important consideration is that current can be passed direct into electrode boilers at up to a limiting voltage of 16,000, thereby cutting out transformers and saving transmission losses. Although installations of this character are in successful use in factories and institutions on the Continent, progress in this country has been comparatively slow. A number of installations has, however, been carried out in recent years.

Where a heavy load of this nature can be restricted to night supply only, it is sound policy on the part of progressive undertakings to offer a very low rate to attract the valuable " off-peak " load, the development of which will do much to improve station load factors and reduce the valleys in the load curves.

### Electric-oil Heat Storage System.

With this system oil is used as the medium for storing heat, instead of the more usual medium—water. The oil, at atmospheric pressure, is contained in a lagged tank and is heated to a temperature of about 550 deg. F. by porcelain-wound elements immersed directly in the oil. In central-heating installations the oil leaves the top of the storage tank and passes through a calorifier into the bottom of the storage tank again. The water being heated passes upwards through the calorifier and on to the radiators. Thermostatic valves operate from the calorifier in order to maintain the latter at a constant temperature. The oil will last practically indefinitely, the maximum operating temperature being about 50 deg. F. below the evaporating point, which gives a good margin of safety against ignition. As the oil can be worked at a much higher temperature than water, a greater amount of heat can be stored in the oil than in water, when taken bulk for bulk. The system also lends itself to the heating of vacuum dryers, pressure impregnators, and other large-scale industrial heating apparatus.

### Electric Furnaces.

In every heat-treatment department, the most important unit is the furnace itself. When due regard has been paid to plant for handling, quenching, &c., the fact remains that unless the furnace is accurate and efficient the department will be a source of trouble, wastage, and delay.

Two essential requirements are necessary if the heat-treatment furnace is to do the work required of it, *viz.*, to provide uniform radiation at all working temperatures and allow of easy and highly-accurate temperature control. The furnace should also have a high thermal efficiency and be free from fumes and gases.

Temperature control is complicated in furnaces, other than electric, by the fact that combustion temperatures are considerably in excess of those required in the heating chamber, and the necessary reduction not only involves high thermal losses, but makes it difficult to maintain uniformity. Variations in calorific values of the fuel and climatic changes also tend to inequalities in temperature, particularly over long soaking periods

The uses to which electric furnaces are very successfully applied include the carburising, refining, and hardening of steel, heat-treatment of aluminium alloys, annealing of ferrous and non-ferrous metals, also enamelling, tempering, drying, and other low-temperature operations.

The chief advantages of the electric furnace may be summarised as follows:—

(1) Normally greater uniformity of temperature throughout the furnaces, enabling a smaller furnace to be installed for a given charge.

(2) Greater efficiency owing to absence of flues, &c., and better insulation.

(3) Entirely automatic regulation of time and temperature, which may be used in conjunction with conveyors and the like.

(4) Ease and accuracy of control of furnace atmosphere.

The electro-magnetic hardening furnace is a particular example of the adaptability of the electrical method. By means of two windings on the furnace, and suitable instruments on the control board, the exact moment for quenching carbon, carburised, and low-alloy steels is automatically indicated. In these steels, the critical point at which the steel should be quenched coincides with the non-magnetic point of the steel, and by the detection of the moment when the steel becomes non-magnetic, the quenching moment is indicated. As the hardening temperature of these steels varies with the composition, and also with the rate of heating, there is no other means of quenching at the exact moment on every occasion.

### Cost of Operating Furnaces.

(1) *Carburising.*—It is found that with a furnace 3 ft. 4 in. by 2 ft. by 1 ft. 4 in., intended for continuous operation, but actually used only 14 hours per day, in which the charge consists of two boxes, approximately 16 in. by 16 in. by 9 in., containing 1 cwt. 3 qr. of steel parts, and weighing 4 cwt. in all, the average period the boxes are in the furnace is seven hours, while carburising is carried out at 900 deg. C. During this period the current consumption is 77 kWh at 0.6d. per kWh, which is the average cost where the furnace is installed. The carburising cost per lb. net is 0.236d. and per lb. gross 0.103d. It will be realised that if the furnace were worked continuously the cost would be reduced considerably.

(2) *Tempering.*—Taking the case of an oven with an inner container 3 ft. 5 in. square and 3 ft. 4 in. deep, installed for tempering steel parts at 215 deg. C., each charge weighs nearly 1 ton, and reaches the required temperature in about 100 minutes. It is soaked for about 20 minutes, and is withdrawn after having been in the oven for two hours. From these figures the output rate of the oven is just under half a ton per hour. The maximum loading is 20 kW and the power required to maintain the operating temperature is 1.7 kWh. The total consumption during the two hours of heating and soaking is 31.8 kWh, from which it will be seen that 66 lb. is treated per kWh. This represents an efficiency of 89 per cent.

This high output and efficiency are due partly to the fact that the oven is well lagged, and also to the special system of forced air circulation. The average rate of heating is increased by no less than 13 times the normal at 100 deg. C. and by four and a half times at 250 deg. C. Furthermore, by extending the area of uniform temperature, the useful heating area of the oven is increased.

(3) *Annealing Brass, Copper, and Nickel Silver.*—As an example of the actual running cost of this class of work, the following is of interest: the loading of the furnace is 88 kW, 3-phase, 25 cycles, 440 volts. Automatic temperature regulation is provided, using the patent expansion element regulator. A time switch is also provided for starting up the furnace in the morning at a predetermined time. The copper, brass, &c., is in the form of coiled wire and strip. The consumption figures for annealing brass are as follows:—

Continuous running, 100 kWh per ton.

Day shift only, 125 kWh per ton.

The furnace has been in operation for some years, and maintenance costs, apart from the re-lining of furnaces, are negligible.

# Steam Conditions and Cycles.

By J. N. WAITE, M.I.E.E., F.I.F.

*The case for high initial temperatures, high pressures, and re-superheating in electric power stations.*

A SURVEY of the history of steam generation and utilisation reveals a never-ending endeavour on the part of power-plant engineers to improve the thermal and commercial efficiencies of power plant, and a never-ending endeavour on the part of manufacturers and metallurgists to keep pace with the demand for higher efficiency, by improvements in design and by rendering available new metals and tools at economic prices to enable the higher thermal efficiencies possible with higher initial steam pressure and temperature to be obtained. This conflict between rising pressures and temperatures on the one hand and the material and tools of construction on the other is very much in evidence at the present time in this country and abroad

It appears to the author that, of recent years, British engineers have been ultra-conservative in their choice of initial steam conditions for new power plant. Most of the new capital power stations have adopted an initial pressure round about 350 lb. per sq. in., with an initial temperature of from 700 to 750 deg. F., and opinion seems to have crystallised that the optimum commercial efficiency is given by these conditions. The main factors to be considered in estimating the optimum initial steam conditions are :—

(1) The capital cost of power plant and thermal efficiency realisable.
(2) The price of coal.
(3) The load factor of the plant.

An alteration in the value of any of these main factors will alter the optimum steam conditions.

The relation between capital cost of power plant and steam conditions is subject to great variation. Each new advance is accompanied by development charges, with the result that the first examples of development are relatively costly, but as experience is gained and output increases, the capital cost falls. It is safe to say that, under present-day conditions, a power plant with initial steam conditions of about 350 lb. per sq. in. pressure and 750 deg. F. temperature would give much better commercial results than a plant with initial steam conditions of about 200 lb. pressure and 550 deg. F. temperature, which were more or less standard some twenty years ago. It may, therefore, reasonably be expected that further advances in initial pressure and temperature will result in decreased overall cost. It should be borne in mind that as higher initial pressures and temperatures become generally adopted, the capital cost of such plant will decrease.

A survey of the coal situation would appear to show that the price of coal for power purposes is far more likely to increase than to decrease. The upward tendency is very noticeable at the present time, and consideration of the economic and political aspects of the coal industry appear to justify the opinion that the cost of coal will continue to increase. Of recent years there has been great progress made in the utilisation of low-grade coal for power stations, and the pioneers are reaping material benefits, but in this connection it is advisable to remember that prices are ruled by the law of supply and demand. Hence, as the demand for low-grade fuel increases, it is inevitable that prices will stiffen, and eventually there will be little financial advantage to be gained by the use of low-grade fuel. Further, where carriage forms a material proportion of the total cost of fuel, the advantages of low-grade fuel disappear, and therefore only stations situated adjacent to the source of coal supply can hope to reap advantage from utilisation of low-grade fuel. The commercial value of thermal efficiency rises with the cost of coal.

### The Effect of the Act of 1926.

In the papers on initial steam conditions that have been read and discussed recently, no attention seems to have been paid to the effect the 1926 Electricity (Supply) Act is going to have on power-station design. The main object of this Act is to concentrate the generation of electrical energy for statutory electricity undertakings in a relatively small number of "selected" power stations. These "selected" stations will fall into two main groups :—

(*a*) "Base-load" stations, operated at a relatively high station load factor.
(*b*) "Peak-load" stations, operated at a relatively low station load factor.

The peak-load stations and the plant thereof already exist, and, as the plant therein reaches the end of its economic life, it is to be expected that such stations will be superseded by other, then existing, stations which, owing to the march of progress, have become relatively inefficient, both thermally and economically, and will thus fall from the high estate of base-load stations. It follows, therefore, that practically no extensions will be made to peak-load stations as such, and in considering the economics of power-station design, both now and in the future, it is only necessary to consider the case of the base-load station, operated at a high load factor.

It appears to the author that this very vital change has not been sufficiently recognised in the recent discus-

sions on initial steam conditions and cycles for power stations.

The foregoing brief survey of the three main factors to be considered in selecting the initial steam conditions and cycles for power plant show :—

(1) That the capital cost of power plant for higher initial pressures and temperatures and modified cycles may be expected to fall as the use of such plant becomes general.
(2) That the price of coal is more likely to increase than to decrease.
(3) That the only plant which will be required for power stations in the future will be for stations having a high load factor.

It appears to the author that the time is now opportune for power-station designers and manufacturers of power plant to face these obvious facts, and to go out boldly for the real optimum initial steam conditions, which, for present-day conditions, appear to be considerably higher than is the general custom at present.

The main argument against increased initial pressure will be the increased capital cost of the plant. It will, therefore, be interesting to see what extra cost—over and above the cost of normal pressure plant—can be borne, and still show a commercial gain.

### Capital Cost of High Pressures.

It will be generally admitted that with initial steam conditions of 350 lb. and 750 deg. F., a station thermal efficiency of 24 per cent. would be a good result, and that, in a capital station employing large units, the capital cost of the items affected by increased steam pressure would be round about £4 per kilowatt installed. As an example of the present-day value of thermal efficiency, assume a base-load station having the following conditions :—

Table I.—Base-load Station Conditions.

*Data Assumed:*

| | |
|---|---|
| Initial steam pressure : | 350 lb./s.i. gauge |
| Initial steam temperature : | 750 deg. F. |
| Terminal steam pressure : | 1.0 in. Hg., abs. |
| Installed capacity : | 250,000 kW |
| Station thermal efficiency : | 24.0 per cent. |
| Cost of coal : | 12s. per ton |
| Calorific value of coal : | 11,500 B.th.u./lb. |
| Station load factor : | 70.0 per cent. |

*Data Derived from Above Assumptions:*

| | |
|---|---|
| kWh generated per annum : | 1,530 millions |
| Coal per kWh generated : | 1.24 lb. |
| Total annual coal consumption : | 848,000 tons. |
| Annual cost of coal : | £509,000 |
| Value of 1 per cent. decrease in coal consumption : | £5,090 |

*Assume Interest and Sinking Fund at 12.5 per cent.:*

| | |
|---|---|
| Capitalised value of 1 per cent. decrease in coal consumption : | £40,700. |

Increasing the initial steam pressure may be expected to cause an increase in the capital cost of boilers, economisers, steam pipes and valves, drain pipes and valves, boiler feed pumps, turbines, and certain feed heaters. The increase in cost of steam pipes and valves should be slight, as much smaller diameter pipes would be required. Many substantial plant items would not be affected, such as air heaters, mechanical stokers or pulverised fuel equipment, coal- and ash-handling equipment, alternators, switchgear, &c. Condensing plant and circulating water equipment would be cheaper, and it is probable that land and buildings would be cheaper. If reheating were introduced into the cycle, the cost of the reheating equipment would be a complete extra over and above the cost of normal plant.

Neglecting reheating for the moment, assume that in a normal design plant as covered by Table I, the items of plant affected by increase in initial steam pressure cost £4 per kW installed. This would give a total of £1,000,000 for these items in a 250,000-kW station. Raising the initial pressure from 350 lb. to 1,400 lb. per sq. in. would yield a decrease in coal consumption of 8.5 per cent. (approx.), and American experience of actual high-pressure plant shows that the extra capital cost of the plant items affected is round about 15 per cent. Table I gives £40,700 as the capitalised value of 1 per cent. decrease in coal consumption, and thus the capitalised value of 8.5 per cent. decrease is £346,000, or 34.6 per cent. of the capital value of the plant affected. Assume that the capital cost of the plant items affected is increased by 15 per cent. by raising to 1,400 lb. pressure; then the net commercial gain on the station outlined in Table I would be £24,500 per annum.

It will be noted that the values assumed to arrive at the foregoing result are conservative ones. If the usual figure of 8.7 per cent. for interest and sinking fund had been taken, the capitalised value of the coal saving would have been nearly 50 per cent. of the capital value of the plant items affected. Consideration of the foregoing arguments would appear to warrant a plea for serious consideration to be given to higher initial pressures for base-load stations.

For a given initial steam temperature and a given terminal steam pressure, the higher the initial temperature the greater will be the wetness fraction of the steam at the exhaust. Even with the moderate initial steam pressures now in use, the increase in efficiency ratio of modern turbines has resulted in serious erosion of turbine blades taking place in the low-pressure stages due to the presence of water liberated during adiabatic expansion. There appears to be reason to believe that blade erosion is considerably accelerated when the wetness fraction exceeds about 10 per cent. As the wetness fraction would rise to about 18 to 19 per cent. with an initial pressure of 1,400 lb. and 750 deg. F. temperature, the importance of keeping the steam dry as far down the turbine as possible becomes more urgent. Three methods are available to overcome this undoubted disadvantage of wetness :—

(*a*) Compartmental drainage between expansions.
(*b*) Increasing the initial temperature.
(*c*) Re-superheating.

Compartmental drainage may be described legitimately as a palliative. It can do good in avoiding erosion and increasing blade efficiency in the low-pressure stages, but it is a palliative and not a cure.

### Advantages of Re-superheating.

Increasing the initial temperature offers the highest thermal gain, but unfortunately the materials of construction available at the moment at a commercial price impose a definite limitation in the upward direction. There appear to be good reasons for believing that the highest initial steam temperature possible at the present time with the normal materials of construction is round about 800 to 850 deg. F. New alloy steels are being developed which promise to extend the upper temperature limit, but considerable experience over an extended time will be required before such special alloy steels become ordinary materials of construction. Even when such materials are available for commercial use, the maximum permissible upper limit of initial temperature will still be too low to inhibit wetness in the steam at the exhaust stages when high initial pressure is used. As the advance will not prevent wetness, and therefore loss of efficiency and blade erosion, it appears advisable to consider seriously the only other method remaining, namely, re-superheating.

Resuperheating appears to be the " Cinderella " of the power-plant world so far as this country is concerned. In technical papers and discussions thereon it is either " damned with faint praise," or with vague misgivings as to whether the theoretical gains will be realised, coupled with many objections to its use on the score of added cost and complexity. The same reasons that lead to an endeavour to increase the initial temperature apply to resuperheating. They are both methods of loading up the steam with heat units that are available for conversion into mechanical work, and thus improving the thermal efficiency, with the complemental advantage of reducing, if not preventing, wetness and thus reducing erosion in the l.p. stages. The author

finds himself unable to believe that heat units introduced into the steam by resuperheating will lose the ability to achieve a thermal gain because they are introduced after partial expansion has taken place, while similar heat units introduced as superheat before expansion retain their ability to achieve a thermal gain. The only difference between heat units used in resuperheating and heat units used in superheating is one of degree—not of kind. If the heat units are introduced when half the adiabatic expansion has taken place, the thermal gain cannot be more than half the gain that would have accrued if they had been introduced before any expansion had taken place. Actually, of course, the gain will be somewhat less than half, owing to reasons well known to those who have investigated the subject. With the advent of extra-high initial pressure steam the case for resuperheating is immensely improved, with regard to both thermal gain and reduction of erosion. It is significant that resuperheating is being used in many new installations abroad using extra-high initial steam pressure, and reports of these installations show that the expected theoretical gains have materialised.

The author has long been of the opinion that a good case could be made out for resuperheating even for moderate pressures, if full credit were given for the benefits to be derived from reduction of blade erosion. Cutting down the wetness fraction of the steam in the later stages is bound to slow up the reduction in blading efficiency ratio which occurs during service. Air-free dry steam would not only reduce erosion, but also corrosion would be prevented, thus again tending to keep the blading efficiency ratio at a higher level through years of service.

With extra-high initial pressure steam the first stage of resuperheating could be economically effected at a pressure as high as the initial pressure of many present-day plants, which would be a great advantage so far as pipe-work is concerned. The increase in pressure and the increase in size of plant units will probably lead to the turbine and boiler (or, at the most, two boilers) together with their necessary auxiliary plant being arranged as a self-contained and independent unit. This would again simplify the arrangements for flue-gas heated resuperheating.

Investigations show that, with high initial steam pressure, two-stage resuperheating would be necessary to keep the steam dry down to the last expansion of the turbine, unless the initial steam temperature can be raised considerably higher than is considered safe at the present time. In this case, practical reasons would dictate that the second stage resuperheating should be by heat exchangers, the heating medium being high-pressure steam.

If the station outlined in Table I be taken, but with the initial steam pressure raised to 1,400 lb. per sq. in., assuming that resuperheating up to 750 deg. F. is effected at 200 lb. pressure, allowing for a 10-lb. drop through resuperheater and pipes, and allowing 80 per cent. blading efficiency up to the resuperheating point, the following facts relating to steam conditions emerge. At this point the steam would be slightly wet, and resuperheating up to 750 deg. F. would enable about 360 deg. F. of superheat to be added. With the assumptions made, about 35 per cent. of the total adiabatic heat drop (straight drop) would occur in the h.p. section of the turbine before resuperheating takes place.

On all modern plants extensive bleeding for feed heating purposes is arranged for, as this is a simple and cheap means of appreciably increasing turbine thermal efficiency. The effect of bleeding is to reduce the amount of steam passing through the l.p. stages, and therefore the amount of heat realised as mechanical energy in the l.p. stages is reduced. Resuperheating increases the heat drop over the l.p. stages, and also increases the proportion of heat realised as work in the l.p. stages by the increase in blading efficiency which occurs owing to the decreased wetness of the steam. The effects of bleeding and resuperheating on the relative proportions of work realised in the respective h.p. and l.p. turbine stages are in opposite directions, and therefore no great alteration in the relative proportions of work is to be expected.

With the assumptions made, we find that about 360 deg. F. of superheat can be added at 200 lb. pressure, with 35 per cent. of the total work done in the h.p. stages before resuperheating takes place. This leaves 65 per cent. of the work for the l.p. stages, using resuperheating. It appears logical to argue that the effect of resuperheating in this case will be 0.65 of what it would be on a turbine having an initial steam pressure of 200 lb. per sq. in. When 200 lb. was a normal initial pressure, no one would have questioned the wisdom of adding 360 deg. F. of superheat to the steam, for it would have reduced the steam consumption by about 28 per cent., and reduced the heat consumption by slightly more than half that amount.

With the station outlined in Table I, but with the initial steam pressure raised to 1,400 lb., without resuperheating, the value of 1 per cent. of the annual coal consumption is £4,660. Capitalised at 12.5 per cent. for interest and sinking fund, a reduction of 1 per cent. in coal consumption is equal to £37,300. Using the more usual value of 8.7 per cent. for interest and sinking fund, the capitalised value rises to £53,600. Assuming a reduction of 6 per cent. on coal consumption can be achieved by resuperheating, then so long as the resuperheating equipment costs less than £223,000 a financial gain would result. In addition, as mentioned earlier, there are good grounds for believing that resuperheating would result in the blading efficiency falling off in service at a slower rate, thus adding to the gain. In the case considered, without resuperheating the exhaust steam would have a wetness fraction of over 18 per cent.; with single stage resuperheating the wetness fraction would be reduced to about 7 per cent. If the initial temperature was raised from 750 deg. to 850 deg. F., the respective wetness fractions would be about 15 per cent. and 3.5 per cent., assuming the resuperheating to take place when the steam was close to saturation point. It appears to the writer that a case exists for resuperheating for base load power stations.

The values in the foregoing have been selected merely to illustrate the points being discussed, and are not put forward as representing optimum steam conditions.

There is no valid reason why a high-pressure, high initial-temperature plant, employing resuperheating in its cycle, should not operate as well as a normal medium-pressure plant. Pioneers abroad report that the theoretical gains are realised in practice, and that the overall cost of high-pressure plant is very little (if any) more than normal-pressure plant; it is significant that these pioneers have in several instances carried out high-pressure extensions, thus showing that they are completely satisfied with the commercial results. It is to be hoped that manufacturers and users in this country will combine to achieve progress and will lead instead of follow in the high-pressure field. The future of steam power stations is bound up with high pressure.

## The Prevention of Dirt on Slip Rings.

There is often trouble through the collection of carbon and copper dust, continually produced by wear, on the slip rings and round the brushes of alternating-current machines. This trouble is greatest where graphite brushes are used, they being soft and the dust produced greasy and clinging.

One way to prevent this trouble is to cut four narrow slots round the circumference of the ring about 1/64 in. deep. These slots can be cut with a hack saw, and will be at right angles to the direction of rotation. Any dust which is worn from the brushes, or atmospheric dust which collects on the rings, will be pushed into these slots by the brushes as the ring rotates.

This method will improve the cleanliness of the rings; it will also reduce the wear, as any abrasive dust will be deposited in the slots, instead of being ground into the face of the brushes.

# Progress in the Cable Industry.

*Lafayette, Manchester.*

By C. J. BEAVER, M.I.E.E.

*Research keeps pace with recent developments in practice.*

THE science and technique of cable manufacture has advanced at a remarkable rate during the past decade or so. It has been stimulated by increasingly rigorous demands of the user, and fostered by the improvement in the research facilities of the maker. These two main influences, precessing rapidly and reacting sharply on each other, have at times almost jostled one another along.

Prior to this epoch, a broad impartial criticism—which it would have been difficult to resist—might have been that its progress was slow compared with that of other branches of electrical engineering. The reply might have been that the urge was less, so far as satisfactory compliance with the demands of practice was concerned, and therein might have been found the reason why advances in the art were during that period less spectacular and impressive, and more concerned with constructional details.

In the period now under review, however, the influence—above referred to—of more rigorous demands has become apparent through two main causes: first, the very substantial increase in transmission voltages, the effects of which are practically entirely confined to paper-insulated cables; secondly, the more widespread and ramified use of electricity, which naturally entails greater variety and more exacting conditions of service, affecting all types of cable.

The second main influence—improvement in research facilities—is, of course, largely a matter of scientific and industrial evolution; but, to the impetus due to the increasing volume of it with time, must be added the effect of the rapidly rising curve of exigency; in other words, the interaction referred to at the beginning of this article. A very appreciable and—from the industrial aspect—significant factor in the improvement of research facilities has been the unification and co-ordination of lines of research. In this country some of the largest and most influential cable manufacturing companies have, during the past three years, grouped themselves for this purpose.

This group, under the title of "Cable Research," operates somewhat on the lines of the various existing research associations, through main and advisory committees, which appoint panels—chiefly from the personnel of the companies comprising the group—to carry out the researches and investigations according to definite programmes.

Without going into details of organisation, the scheme affords scope for closely concentrated research work under economical and highly efficient conditions, and allows the appropriate grade of "talent" to be employed in the elucidation of any given problem or field of investigation. In effect, the group operates on its own concentrated problems, while co-operating with other research associations of a more voluntary character, having wider spheres of action and terms of reference.

The avoidance of overlapping of the research work of individual firms, and the co-ordination of fundamental ideas and aims, without destroying the individuality of the component concerns, cannot but be for the ultimate good of the whole electrical industry. The benefit to the cable-making art of this "pooling" of resources and personnel has already proved appreciable, and in the future it will undoubtedly be very great. The contrast between unified schemes and lonely furrows is perhaps more marked in research than in any other kind of work. It is accentuated when the researches are of an industrial character; that is to say, where the results of many of them have necessarily to be translated more or less directly into industrial applications.

## High-voltage Transmission.

Turning from this outlook—which mainly concerns the future—to a survey of the developments of the past few years, the most prominent achievements in the public view are assuredly those relating to the high-voltage transmissions such as are now in everyday use on the British grid and elsewhere. These transmissions comprise a large amount of 33-kV cable, a smaller amount of 66-kV cable, and a small mileage of 132-kV cable.

In view of early troubles—by no means confined to British cables—the satisfactory results which cables are now giving at the first two mentioned voltages are gratifying. The third—for which only the Pirelli oil-duct system has so far been used on a practically commercial scale—has not yet been tried out in this country, though favourably reported on in America and Italy.

The forms of cable chiefly used for 33 kV have been either the H-type, three-core, the screened or unscreened S.L. three-core (each core separately lead-sheathed), or single-core types, usually having a metallic screen of metallised paper or copper tape over the dielectric; while for 66 kV they have mostly been of single-core type, with one of the above-mentioned types of metallic screens over the dielectric.

It is of interest to note that a considerable mileage of 33-kV cable of the despised and rejected "belted" type

is still in operation without mishap after several years' service, a fact which has caused more than one power supply engineer to wonder whether this cheap and simple form of cable was condemned on insufficient grounds and without due research into the causes contributing to its impeachment for pressures above 22 kV.

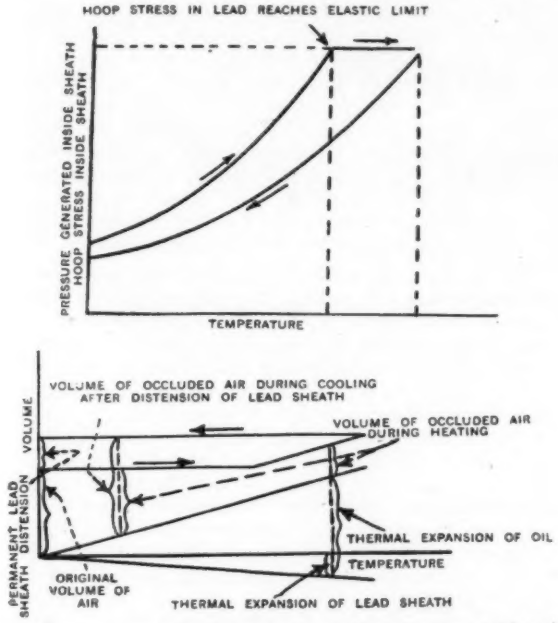
HOOP STRESS IN LEAD REACHES ELASTIC LIMIT
PRESSURE GENERATED INSIDE SHEATH
HOOP STRESS INSIDE SHEATH
TEMPERATURE
VOLUME OF OCCLUDED AIR DURING COOLING AFTER DISTENSION OF LEAD SHEATH
VOLUME OF OCCLUDED AIR DURING HEATING
VOLUME
PERMANENT LEAD SHEATH DISTENSION
THERMAL EXPANSION OF OIL
TEMPERATURE
ORIGINAL VOLUME OF AIR
THERMAL EXPANSION OF LEAD SHEATH

**Fig. 1.—Physical Behaviour of Lead-covered Cable with Sheath Distension.**

True, the urgency was great, but it is at least open to speculation as to whether—given the improvement in materials and manufacturing methods which were then coming to fruition—the limit of usefulness of this type had been reached at 33-kV working pressure.

Risks of failure under present conditions of production are largely dependent on the physical stability of the dielectric, because it determines the susceptibility to the production of conditions which permit ionisation to occur at the working stress, temperature, &c. To put the matter in another way, all well-made cables are electrically stable in their initial state, but they may become electrically unstable under the action of temperature cycles when a certain critical temperature is exceeded. From the voltage point of view, therefore, the aim of design should be to obtain the highest degree of physical stability without sacrificing other properties.

### Physical Effects of Temperature.

Research has shown that power factor/voltage characteristics in conjunction with temperature-cycle tests—on the lines described by the writer[1] in 1928—afford a useful criterion of electrical stability, and furnish proof as to whether the concomitant physical stability has, under the temperature-cycle conditions, been detrimentally affected. The power factor/voltage test has now been added to the usual commercial routine tests on supertension cables, while the combination of temperature-cycle tests therewith has been widely adopted as a type test, albeit the number and range of temperature cycles —features of the utmost importance—have not been standardised. To a great extent, however, the limiting factor appears to be the permanent expansion of the lead sheath, leading to the formation of vacuous (ionisable) spaces and/or to the expansion of, and the lowering (on cooling) of the gas pressure in the already existing gaseous spaces, thereby helping the production of ionisable conditions.

Fig. 1 illustrates diagrammatically the relative contribution of the components of a cable to this result.

[1] *Jour.* I.E.E., 1928, Vol. 66, p. 831.

In the lower part of this figure, volume is arbitrarily plotted against temperature, and it can be seen that, up to a certain temperature, the excess thermal expansion of the impregnating medium over that of the sheath is accommodated by compression of the occluded air or gas (compressible matter) in the dielectric, by reason of the building up of an internal pressure within the lead sheath, until the hoop stress in the lead sheath reaches the elastic limit stress for lead. Beyond this critical temperature the lead cannot compress the compressible material any further, and is itself strained beyond its elastic limit, as indicated in the upper part of the diagram. On cooling, the internal volume of the lead sheath exceeds its original volume by the amount of the resultant permanent distension, and consequently the pressure of the occluded air or gas is lower than before, and its volume is increased; hence ionisation will occur at a lower voltage.

Fig. 2 correspondingly illustrates the physical behaviour of lead-covered cable under action of the temperature cycles when no lead-sheath distension occurs, and shows the case in which, for a similar temperature range and internal volume, sufficient compressible matter is incorporated in the dielectric to ensure that the hoop-stress in the lead sheath does not exceed the critical value, and no permanent distension of the lead occurs; that is to say, the cable so constructed is physically stable for the maximum temperature to which it has been subjected.

Undesirable as lead may be on account of its deficiency in strength and its low elastic strain, its use is essential on account of the flexibility requirements of cables in manufacture, transport, and installation. To a certain extent its deficiencies can be remedied by alloying or by reinforcing it. Alloying hardens and stiffens it without interfering unduly with the bending requirements above referred to, while a reinforcement of stronger metal of high elastic strain—to comply similarly with flexibility requirements—has to be spirally disposed in wire or strip form in or upon the sheath. The ideal condition would be to embed such reinforcing metal in the wall of lead, but as this is a practical impossibility the alter-

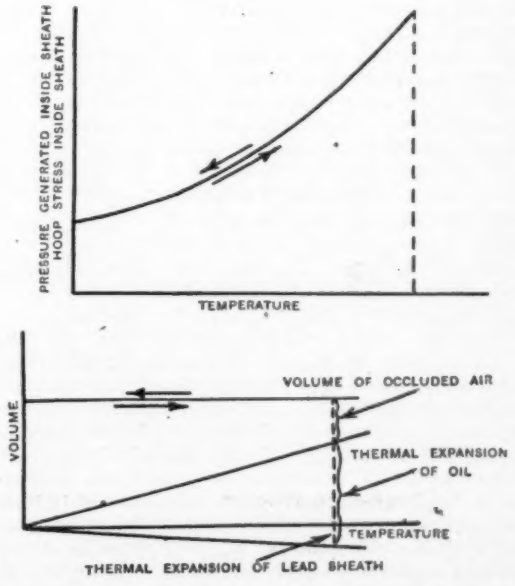


**Fig. 2.—Physical Behaviour of Lead-covered Cable without Sheath Distension.**

native is to wrap it on the lead sheath very tightly, so that it is immediately effective when an internal pressure arises in the cable. It is important to provide against lateral distension of the lead sheath, which tends to result from the radial restriction imposed by the reinforcement. For these reasons, the writer prefers, first, to apply the high tensile reinforcing wires or strips

in opposite directions under heavy tension, and, secondly, to anchor them at regular intervals to each other, and to the lead sheath by spot welding.

### Incorporation of Compressible Media.

Another method of attack on the internal pressure problem is to minimise it by incorporating a compressible medium in the cable construction. This medium has of necessity to be of a gaseous nature, because all solid media—not excluding rubber, as proposed in one patent specification—are practically incompressible. Other requirements necessitate that the volume of gas has to bear at least a certain minimum relation to the net amount of expansion in the cable (see figs. 1 and 2) so that the allowable internal pressure at the maximum working temperature shall not cause the elastic limit of the sheath to be exceeded. As the necessary volume of gas is appreciable, most of the proposed methods entail its enclosure in compressible capsules or tubes arranged or distributed throughout the length of the cable. A further requirement which follows is that such volumes of gas have to be kept out of the dielectric field.

The interior of hollow conductors, the padding spaces in three-core H-type cables, and the outer annulus between the lead sheath and the dielectric boundary have been variously selected as suitable positions by different inventors, but great difficulties exist in the development of suitable gas containers. Air or gas in solution in the impregnating medium has been suggested, but this method would require very delicate adjustment to avoid the risk of their existing in ionisable form or dimensions under certain conditions of working temperature and pressure. On the other hand, residual air in the microscopic interstices (cells and canals) of the paper are capable of functioning according to the P/V law, and—given sufficient physical stability in the impregnating medium—of not becoming aggregated into ionisable form or dimensions under the highest working temperatures which are practically feasible. This method is actually embodied in one type of cable which is in successful use.

It will readily be seen that the effective development of this line of attack would obviate the use of external-pressure compensating devices; the distribution of internal pressure in the cable would be uniform throughout its length; and the cost of reinforcing the lead sheath would possibly be avoided. From the general aspect, embracing installation maintenance and general risks of operation, there is no doubt that some such solution would approach the acme of commercial efficiency and would be welcomed by power engineers.

### Mine-shaft Conditions.

It will have been noted by the reader that the physical aspect looms large in the general perspective of these problems. In other directions, also, there is a marked tendency to accord to this aspect the attention it merits, nay, demands. A notable instance of this relates to the introduction, during the past few years, of high-voltage cables for mine-shaft power transmission. The physical difficulty in this case has hitherto been that the impregnating medium of ordinary paper-insulated cable has, by reason of the combined effect of high working temperature and vertical position, tended to flow to the lowermost parts. The practical result was frequently the bursting of the lead sheath of the cable. Although this was usually attributed to the hydrostatic pressure set up by the head of oil, the real sequence of events under successive cycles of heating and cooling was probably: (1) the gradual migration of incompressible (liquid) matter from the upper to the lower end of the cable; (2) in the absence of compressible matter at the lower end of the cable the expansion effects—of the nature of solid dilatation—produced by subsequent heating of the cable, causing permanent distension of the lead sheath; (3) the flow of oil into the expanded cross-section in readiness for the next heating; (4) repetition of solid dilatation, and production of a further increment of permanent distension, and so on to ultimate failure.

This trouble of the bursting of lead sheaths was avoided rather than met by the stipulation laid down by the users, and accepted—or, shall we say, condoned—by the majority of makers, that the "free" impregnating material should be drained from the dielectric before lead sheathing, special tests being devised to prove the thoroughness of the drainage operation. As the compound displaced by draining could only be replaced by air, it is clear that such procedure was diametrically opposed to the attainment of dielectric efficiency, and would obviously impose a low limit of working stress on the insulating material. For a number of years, however, the respective purposes of user and maker were fulfilled, the disappearance of cases of burst lead sheaths satisfying the former, and the latter escaping Nemesis by reason of the fact that at the usual working pressures (not exceeding 2,000 volts), the dielectric stresses were not of sufficient magnitude to produce ionisation of the air spaces and consequent electrical breakdowns.

The demands of engineering progress are sterner realities than can be met by compromises which are little short of subterfuges, and in due course the time came when the economical considerations involved in pursuing mining projects to the utmost limits of distance underground made it imperative considerably to augment shaft-transmission voltages. The desirability existed, and was mooted nearly ten years ago by the gold mining engineers in South Africa, but from what has already been said regarding super-tension cable problems, and considering the additional difficulties entailed by vertical runs and high ambient temperatures, it is perhaps not surprising that the mining world has waited until within the last three years to see the pioneer instance of a 20-kV transmission down a vertical shaft, several thousand feet in depth. This was installed at Crown Mines, Witwatersrand. A further similar installation has since been made at another Rand Mine, and, in view of the opinion held in some scientific quarters that paying quantities of ore may exist at more than twice the present working depths, the importance of the high-voltage projects from the gold-mining point of view can hardly be over-estimated.

As already indicated, this achievement has only been rendered possible by the co-ordination of the physical with the electrical requirements. The constructional details and methods of manufacture employed are not within the scope of this article, but they have been described at some length in this journal[2] on the basis of a paper on "The 20-kV Underground Transmission System at Crown Mines, Ltd.," by Messrs. W. Elsdon-Dew and H. Denehy[3], in which the lines of the cable maker's attack on the problem are indicated in detail.

### Protection from Chemical Effects.

A review of cable developments would be incomplete without reference to the chemical aspect, and it would indeed be surprising if, in view of the extended and varied usage of cables, the requirements regarding their chemical protection had not become more exacting. To some extent this is more apparent than real, because much of it is due to having more attention—or the individual attention of more people—drawn to corrosive effects or deficiencies in protection. On the other hand, it must be the case that with the great increase in the use of electricity, the chances of electrolytic corrosion due to vagabond currents from various sources are augmented. Further, it is a fact, which is even now insufficiently recognised, that nearly all corrosion that is capable of leading to serious damage and failure is electrolytic in character, and that purely chemical corrosion—as one may term it for the sake of simplicity—has seldom more than comparatively superficial effects. No more need be said here on this point, except to emphasise that considerable experience is necessary to ensure accurate diagnosis.

*(To be continued.)*

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[2] Electrical Review, October 11th, 1929.

[3] *Trans.* South African I.E.E., Vol. XX, Part 7, p. 160.

# The Economics of Rural Electrification.

Elliott & Fry, London.

By W. C. BEXON, M.I.Mech.E., M.I.E.E.,
*Engineer and General Manager to the Ayrshire Electricity Board.*

THE electrification of rural areas is now receiving much consideration by electricity supply authorities throughout the whole country. Municipalities are obtaining Parliamentary powers to supply outwith their existing areas of supply, and new companies are being promoted for the purpose of supplying electricity in many rural areas in the country. Power companies with huge industrial areas are turning their attention to tapping their existing extra-high-pressure transmission lines for the purpose of supplying intervening villages, &c.

During the progress of the Electricity (Supply) Bill, which became an Act in 1926, it was often stated that people in country villages, farms, &c., would greatly benefit by this Act, as it would give facilities for the development of electricity in those sparsely populated areas. Parliamentarians had expressed the opinion that the average price of electricity to the residents in villages and farms would not be more than 1d. per kWh. How often are people misled by the politician and the Parliamentarian! What a great thing is faith!

Since the 1926 Act has become law, all the attention has been given to the erection of extra-high-pressure transmission lines over the whole country, and the interconnection of the super-stations of the country, although these transmission lines pass, or will pass, through villages and near to farms and isolated places, it has been found uneconomical to tap them for supplying those villages and farms. How disheartening it is to the farmer and the villager to know that the supply is not available; although it is so near, it is yet so far. To supply these places it is left for municipalities and companies to take the risk, and develop the rural areas. There is no shadow of doubt that there is a big financial risk in rural electrification. In the term "rural" I mean "truly rural," not an area where there are factories and workshops, but an area which consists of small villages, farms, country houses, and small cottages occupied by the farming community. The revenue to be derived will be from lighting, heating, cooking, and small power from the farms, &c.

## Capital Cost.

The density of the population in rural areas is considerably less than in towns, and in some districts averages only 150 persons per square mile. In certain areas the dwellings average 27 to the acre. It will be readily understood, therefore, that to electrify this type of rural area the capital cost of distribution will be excessively high. The author has in mind a rural area of 27,000 acres with a population of 6,500. To electrify this area completely would cost £40,000, which means an annual standing charge of approximately £3,600. The capital cost per dwelling would amount to £40, and the capital cost per head of the population would be approximately £6.1. Comparing these figures with the distribution cost of supplying dwellings in towns, it will be realised why I used the word "risk" at the commencement of this article. In addition to the fixed capital costs, there are the many transformer and line losses. Owing to there being practically no power load the magnetising losses in the transformers during the day will be very great.

## Consumption and Revenue.

As to the revenue derived from rural electrification, it cannot be expected that the agricultural labourer will use electricity freely, and I doubt if from this source a higher maximum than £2 per annum can be expected. I am of the opinion that with his present wage the agricultural labourer cannot afford to hire or use either an electric cooker or radiator, and he has no use for an electric vacuum cleaner. So far as the revenue from farms is concerned, it will be derived chiefly from lighting and heating. The farmer does not make full use of electric power, owing to the fact that he requires to use horses, and, furthermore, is a great lover of this dumb friend. The milking machine which was used fairly extensively is now being discarded by farmers, and the old method of milking is being resorted to. Electric ploughing, in the writer's opinion, will not be used to any great extent.

The following figures show to what extent electricity is used on 70 farms. The total number of units used over twelve months for lighting was 22,448; for heating, 14,961; and for power, 15,959, only 19 of the farms using electricity for power purposes. The total revenue received from these farms for the year was £747 10s., which gives an average of £10 3s. per annum. There is no reason to believe that the Scottish farmer is less alive to the advantages of electricity than his southern friend. The average acreage per farm is 175 acres. Taking an average dwelling throughout a rural area, in the author's opinion, £5 per annum is a reasonable figure to expect. Large country houses in rural areas are few and far between, and, owing to taxation, they are becoming less in number. Considering, therefore, the high capital distribution costs, the small density of the population per square mile, and the low average revenue derived from each consumer, rural electrification from the financial point of view is a doubtful proposition. The question, therefore, is how is it possible to make such schemes a paying proposition? There is no doubt that

if the capital cost could be reduced it would tend to assist in that direction.

### Cost of Construction.

The Electricity Commissioners have issued new regulations dealing with overhead lines, and these regulations have caused reductions in the cost of overhead distribution; nevertheless, there is much more room for these regulations to be further ameliorated. The author suggests the following:—

*First*, the regulation dealing with ice loading should be altered, and a lesser figure allowed.

*Secondly*, lesser clearances between the lowest wire and the ground. In rural areas, where the overhead lines could be run along the hedgerows and away from the public roads, 12 ft. clearance would be perfectly safe; a further advantage of erecting the lines along hedgerows would be that lower wayleave rentals would be expected, and fewer objections would be raised by the owners and tenants of the land. The present objection to overhead lines is that the poles are erected direct through cropping fields, and the farmer maintains that the cost of cultivation round these poles causes him a lot of extra expense. The capital cost per mile of transmission line would also be decidedly less under these conditions than it is at present.

*Thirdly*, a longer sinking fund period should be allowed in the development of electricity in rural areas.

*Fourthly*, a new Electricity Act ought to be passed to give powers to electricity supply undertakings to erect overhead lines over private and public property. The time and expense of obtaining wayleaves is getting greater each year, and the difficulties are increasing.

Another serious point is the question of rating, which does hamper rural electrification. That an electricity supply undertaking which has transmission lines passing through a parish should have to pay rates to that parish, although the undertakers are receiving no revenue from that parish, is not justice.

### Tapping E.H.P. Lines.

Now, dealing with the construction of overhead lines, I have already expressed my views on the present regulations, and I now offer suggestions for tapping e.h.p. transmission lines for supplying villages and farms in rural areas.

The e.h.p. 3-phase switch and fuse at present on the market are far too expensive. There are too many insulators, which not only add to the cost, but are also a source of weakness. A combined switch-fuse, having six insulators in all, two per phase, would prove to be satisfactory. From the author's experience, a glass tube filled with powdered chalk through which the fuse wire is passed affords efficient protection, and the cost of replacing the fuse is only a matter of a few shillings.

The weight of transformers at present is far too great, which necessitates a costly method of staging, and the erection costs are high. Considering that transformers for rural electrification are called upon to take full load for only a short period of the year, and also that during the major portion of the day they are only on very light load, the rating and regulations could be altered, which would cut down the cost. In a large scheme of rural electrification many transformers will be required, and no attempt should be made by the manufacturers, in order to minimise the capital costs, to lessen the life of the transformer. The cost of taking down a faulty transformer which is situated in the open country many miles from the undertakers' stores and replacing it by a new one would entail a great deal of expense, and far outweigh the reduction in the capital cost in the first instance. Dead time in erection of rural lines amounts to from 15 to 20 per cent. of the total cost.

Some engineers are considering the use of iron wire for the conductor as against copper, on account of its very much lower cost. The disadvantage of this is that the value of iron wire as scrap is nil, whereas copper wire has always a good market value as scrap, even after it has been in use for many years. Another serious objection to iron is that where it is used in a chemically laden and salt atmosphere it very soon deteriorates.

### General Considerations.

It may be suggested that to obtain a better financial return from rural electrification schemes the charges for electricity should be increased, but the greater number of people residing in rural areas cannot afford to pay higher electricity charges, and in the end, therefore, any such increase would defeat its object.

The author, being in charge of an electricity undertaking which has a distribution area of over 1,100 sq. miles, a large proportion of which is rural and in which the rates for supplies are the same throughout the whole area, finds himself in the very difficult position of having to launch out on rural electrification schemes sometimes situated 15/20 miles away from the source at which electricity is generated, and at the same time to endeavour to make the schemes such that they will not result in a financial loss.

There are many parts of the country similar, and, in the author's opinion, if rural electrification is to be a success, then Parliament must give electricity undertakings better and easier wayleave facilities. The Electricity Commissioners must come to our aid and ameliorate the present regulations dealing with overhead lines, and the manufacturer must put on the market good, economical, and cheap apparatus required for rural electrification. The rating system of electricity undertakings ought to be amended, more especially of those in Scotland. A number of Scottish undertakings are paying at the present time almost as much, and in some cases more, in rates and taxes than they are paying for the fuel they use. The undertakings in England are not "bled" so much as those in Scotland.

If these suggestions are carried out rural electrification will soon be an accomplished fact, and the country dweller will have the same facilities with regard to electricity as a person residing in a town. Towns have developed when electricity has become available, and if rural electrification were carried out the rural areas would also develop; people now residing in towns would emigrate into the country, which, in the end, would result in cheaper electricity for all.

The cost per kWh of generation is infinitesimal, compared with the cost of distribution in rural areas, and even were the grid charges found to be less than those at which economical stations can generate at present, rural electrification will not, in the author's opinion, be a success until the suggestions made in this article have been carried out, and he, therefore, ends by advising municipalities which are considering rural electrification to "gang warily."

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### Electricity Board Wayleaves.

At a recent meeting of the North Riding (Branch No. 2) Executive of the National Farmers' Union at York, the secretary, Mr. F. S. H. Ward, warned landowners and farmers to be careful about the wording of agreements come to with electricity concerns, whose views with respect to wayleaves varied enormously. At present their district was concerned with a line from Scarborough to Bridlington and another circling around Malton. In the near future lines would spread greatly, not keeping to the roads, but going over the land. The subject of rental was therefore of great importance. He had fixed up terms with the Central Electricity Board at a rental for arable land of 10s. per pole and for other land of 5s. per pole. Other electricity concerns offered 4s. per pole and some as little as one shilling per pole. The agreement covered cost and valuation for any damage done. They would get full compensation from the Central Electricity Board for damage done by the erection of poles and their maintenance, in addition to the rentals. It might not be so easy with companies, which were commercial concerns out to make as much as possible for their shareholders. He was now negotiating with the Cleveland and South Durham Co. Farmers were not inclined to hamper the development of electrical schemes in rural areas; on the contrary, they wanted to assist, but they had to bear in mind disabilities associated with the erection of transmission lines.

# The Two-Part Tariff.

Elliott & Fry, London.

By D. J. BOLTON, M.Sc.(Eng.), M.I.E.E.

THE way of the tariff maker is hard, in electricity supply almost as much as in politics. Starting off perhaps with a fine scientific ideal, that of discovering the true and equitable cost of supplying each particular consumer, he carefully weighs every expense and scrutinises the contents of every pay envelope. But no sooner has he done this than it must all be undone again at the bidding of a commercial sales policy—for this scientific "costs" tariff proves too hopelessly uncompetitive in some directions, whilst in others it charges less than the consumers are willing to pay. The tariff maker has in fact to be Doctor Jekyll and Mr. Hyde—the benign and scientific Doctor Jekyll marshalling costs in a spirit of abstract justice, and the shameless profiteering Mr. Hyde grabbing all when he can get it and cutting prices when he cannot. The influence of this conflict of functions can be seen in the tariffs themselves when reviewed in the light of actual costs, and the object of the present article is to throw a little fresh light on this point. Incidentally, it will be found that one of the apparent discrepancies is less real than it appears to be.

Probably the greatest invention in electricity supply economics was that of the two-part tariff, made almost fifty years ago. The case for such a tariff can be very well shown by comparison with the two other sorts of domestic supply, gas and water. In gas supply, owing to the relatively simple plant and ease of short period storage, the capital involved is on the average only some two-and-a-half times the annual turnover, and in consequence gas is usually sold on a simple quantity tariff independently of the rate of consumption. Water supply, at the other end of the scale, involves capital expenditure of something like thirteen times the annual turnover, and it is commonly sold by a fixed tariff on "maximum demand" (as estimated from rateable value) without any quantity charge. In the case of electricity supply, the capital expenditure averages six times the annual receipts, so that it lies just mid-way between the other two. It would therefore appear only logical that in this case there should be a combination of the two sorts of tariff.

Unfortunately, the two-part system is no panacea for tariff troubles, and whilst solving some difficulties it has created others. In power supply it has given good service; it appears to cater perfectly for load factor and it can be extended without much difficulty to deal with power factor. But when applied to domestic consumers difficulties arise, first in measuring or estimating the maximum demand, and secondly in adjusting the two portions so as to give an equitable and at the same time a competitive tariff. The first difficulty can be overcome, without additional metering or mystifying technicalities, by basing the fixed charge on rateable value, floor space, or the like, and this method has been extensively employed for encouraging the domestic non-lighting loads. The second difficulty can be best illustrated by an actual case. In the author's house there is a number of electric fires and other apparatus on a separate "power" circuit, totalling some 10 kW in all. Of that there has been as much as 5 kW in use at once on several occasions during the two winter quarters. Assuming that the summer maximum never exceeded 3 kW, this would still give a mean yearly maximum demand of 4 kW which at a figure of £5 per annum per kW (a fair average figure for an ordinary industrial power tariff) would cost £20 a year for the fixed charge alone, quite apart from any charge made for the actual consumption. Yet the author's annual bill for this power circuit is only in the neighbourhood of £6, which seems to suggest either that he is grossly undercharged, or else that there is something wrong with a fixed charge of these dimensions when applied to domestic non-lighting consumption.

The explanation is that a two-part tariff which is perfectly fair and low enough to bring in business with an industrial consumer having a load factor of 30 per cent. may be impossibly high for the low load-factor domestic heat consumer *because no allowance has been made for the latter's superior diversity factor.* The plain two-part tariff based on actual costs penalises the consumer in exact proportion to the poorness of his load factor, so that consumption at a load factor of 5 per cent. has to carry six times the fixed charge of consumption at a load factor of 30 per cent. But the 5 per cent. load factor consumer does not put the supply authority to six times the capital expense, because he is *bound* to have a better diversity factor. In fact it has been estimated that in electric cooking (which is probably the extreme case) the individual load factor may be as low as 5 per cent., whilst the total cooking load may approach a load factor of 50 per cent. Moreover, not merely the generating stations, but also the street mains get the benefit of this diversity, since next door neighbours will have different habits and times of maximum demand.

The obvious way of meeting this difficulty is to adjust the proportions of the two parts of the tariff, altering them from their original "economic" values (based on costs) in the direction of less on the fixed and more on the running portion. This process of adjustment has in fact been made by very many of the supply authorities in their tariffs, but too often it has been done haphazard and without any consciousness of its scientific basis and justification. The result has been enormous discrepancies, not only in the magnitudes (which is at present inevitable), but also in the *proportions* of the tariff parts, discrepancies which make any uniformity of treatment in economic problems very difficult. In order to prove these statements both as to the adjustments which have been made and as to the erratic nature of the adjustments, it is necessary to carry out an investigation into costs on the one hand and tariffs on the other. The following survey is a slight attempt at this somewhat ambitious task—a task which, if fully carried out, might lay the

basis of a scientific and uniform method of proportioning the tariff parts.

Taking first the question of costs, the figures employed are those for the authorised undertakings of Great Britain in the year 1927-8 as given in the Commissioners' latest return. As regards the capital charges, it was found that the excess of receipts over working expenses in that year amounted to 8.68 per cent. of the total capital outlay. A uniform figure of this percentage was therefore assumed in assessing the capital charges, the annual charge for each group of plant being taken as 8.68 per cent. of its first cost. The whole of these charges were, of course, assigned to the fixed portion of the tariff. As regards the working expenses of generation, certain proportions of the fuel, oil, wages, and repairs were assigned to the fixed portion, as laid down in the "Electricity (Allocation of Cost of Production) Regulations, 1929"* and the remainder were assigned to the running portion of the tariff. These assignments vary with load factor, and in this case they were worked out for the average station load factor for the country, namely 30 per cent. As regards the remaining expenses—management, rents, rates, and taxes—they were all allocated to the fixed charge, but were split up into two portions, namely into generation and into transmission and distribution, in the same ratio as the capital expenditures under these two heads.

Adding up all the expenses assigned to the running portion and dividing by the total units generated gave a figure of 0.184d. per kWh at the generating station. In order to obtain the fixed charge at the generating station, it is of course necessary to add up all the other generating expenses and divide by the aggregate maximum load on the stations. But consumers purchasing at the station bus-bars would have some diversity amongst themselves, and to obtain the correct figure to charge them on their individual maximum demands it is necessary to divide by a diversity factor, which in this case was assumed to be 1.25. The calculation then gave a fixed charge at the station of £4 7s. per annum per kW of demand. By combining these two portions a theoretically correct two-part tariff was obtained, adequate to cover all costs for consumers purchasing at the generating station.

In finding the correct price to charge for energy as distributed to the average consumer in the country it is only necessary to take account of the additional items due to transmission and distribution. As regards the running charge per kWh, the numerator is the same as before, namely the major part of the fuel, &c., but the denominator is no longer the total units generated but the total sold, and this gives a figure of 0.222d. per kWh. As regards the fixed charge, the numerator is increased by the capital charges and working expenses of transmission and distribution. The denominator is also increased due to the greater diversity factor resulting from the larger number of consumers, but it is a matter of considerable difficulty to say how much should be allowed for this. Some help may be got from the figure given in the return for the total load connected to the systems of authorised undertakers, which when divided by the aggregate maximum load on these same systems gives a quotient of 2.38. Probably it would be safe to assume that transmission and distribution will result in an additional diversity factor (beyond that already allowed for) of 1.6, making a total diversity from the average consumer to the station of 2.0. This gives a fixed charge to the consumer of £5 19s. per annum per kW of demand.

Table I summarises the figures and results thus obtained. The final column shows the numerical ratio existing between the fixed charge in £ p.a. per kW and the running charge in pence per kWh. This ratio will be found a useful method of expressing the proportions of the two parts.

Turning now to the other side of the picture, namely tariffs, a very different state of affairs becomes evident. Taking first a few systems at random, Table II gives the power tariffs for several of the larger undertakings.

* No. 1015, H.M. Stationery Office. Price 1d.

TABLE I.

*Fixed Charges.*

| | £10⁶ |
|---|---|
| Capital charge for generation ... ... ... | 9.67 |
| Proportion of fuel, oil, wages, &c. ... ... | 5.25 |
| „ „ management, rates, &c. ... ... | 2.61 |
| Total for generation ... ... ... | 17.53 |

Aggregate maximum load on generation stations ... ... ... ... $3.23 \times 10^6$ kW

Fixed charge at station, assuming 1.25 diversity factor:

$$\frac{17.53}{3.23 \times 1.25} = 4.34 \text{ £ p.a. per kW.}$$

| | £10⁶ |
|---|---|
| Capital charges for transmission and distribution ... ... ... ... ... ... | 13.67 |
| Distribution working expenses ... ... ... | 3.74 |
| Proportion of management, rates, &c. ... ... | 3.68 |
| Grand total ... ... ... ... ... | 38.62 |

Final fixed charge, assuming 2.0 diversity factor:

$$\frac{38.62}{3.23 \times 2.0} = 5.96 \text{ £ p.a. per kW.}$$

*Running Charges.*

Remaining proportions of fuel, &c. ... $6.47 \times 10^6$£

Units generated ... ... ... ... $8{,}451 \times 10^6$ kWh

Running charge at station $\frac{6.47 \times 240}{8{,}451} = 0.184$d. per kWh

Units sold ... ... ... ... ... $7{,}003 \times 10^6$ kWh

Final running charge ... $\frac{6.47 \times 240}{7{,}003} = 0.222$d. per kWh

*Summary of Costs Results.*

| | Fixed charge p.a. per kW. | Running charge per kWh. | Ratio |
|---|---|---|---|
| At station | £4 7 0 ... | 0.184d. ... | 23.5 |
| Distributed | £5 19 0 ... | 0.222d. ... | 26.8 |

TABLE II.

| | Fixed charge p.a. per kW or per kVA† | Running charge pence per kWh. | Ratio |
|---|---|---|---|
| Bradford ... ... | £4 10 0 ... | 0.5 ... | 11 |
| Glasgow | | | |
| (e.h.p., a.c.) | 4 15 0 ... | 0.23 ... | 26 |
| (l.p., d.c.) ... | 7 15 0 ... | 0.3 ... | 26 |
| Leeds ... ... | 3 10 0 ... | 0.4 to 0.29 ... | 11 to 15 |
| Liverpool | | | |
| (Lighting) ... | 8 0 0 ... | 2.0 ... | 4 |
| (Power) ... | 6 0 0 ... | 0.5 ... | 12 |
| Manchester ... | 5 0 0 ... | 0.5 ... | 10 |
| Sheffield ... ... | 4 0 0 ... | 0.25 ... | 20 |

† When the charge is per kVA a power factor of 0.8 at the time of maximum demand has been assumed in calculating the ratio.

Even in this small selection a wide divergence is noticeable, both amongst the figures themselves and between them and the cost figures. Only in one case, that of Glasgow, is the ratio anything like that which appears to be justified by the costs. Pushing the investigation further, a table was compiled of all the straightforward two-part tariffs of authorised undertakings in the country in 1929. This is somewhat later than the period covered by the Commissioners' return, but one is considering not so much the actual tariff figures as the ratio between them. The results are shown in Table III.

TABLE III.

| Total number considered. | Value of ratio: £ p.a. per kW÷pence per kWh. Maximum. | Minimum. | Average. |
|---|---|---|---|
| 146 ... ... | 32 | 2.5 | 10.5 |

Too much should not be made of the extremes shown, since they may often have been designed to meet particular local conditions, but the average is certainly significant. It will be observed that what appears to be the correct ratio based on costs is almost exactly two-and-a-half times the mean ratio actually employed in this country.

It is impossible within the present limits to consider further a topic which clearly demands much fuller treatment. But enough has been said to show that there is here a definite attempt on the part of the tariff framers to load the economic scales in favour of the low load-factor consumer, and so to give him credit for his probably superior diversity factor. Whether the allowance has been by guess-work or by design, whether too much or too little, remains to be proved.

# Domestic Developments in the Convention Area.

*Accounts of the progress made by the Eastbourne, Brighton, and Hastings undertakings in providing "Electricity for the Home."*

## Eastbourne.

The total number of meters connected to the system at Eastbourne at the present time is over 19,000, the majority of which represent domestic consumers. Under an assisted wiring scheme in vogue, the rent for wiring is obtained by an additional charge of 2d. per kWh over the normal rate of 3½d. The scheme now covers 190 streets, in which there are over 3,500 consumers.

Electric cookers are let on hire by the department at rates varying from 2s. 6d. upwards, according to the size of the cookers, and free wiring up to 40 ft. is included in the hire charge. There are at present out on hire 970 cookers, 858 kettles, and 173 water heaters.

A visit to "Electric House," the headquarters and showrooms of the undertaking, reveals the energy and thoroughness with which the borough's electricity business is handled, particularly in connection with the domestic supply activities.

**Night View of "Electric House," Eastbourne.**

The premises themselves are commodious. The ground floor is given up to spacious, well laid out and beautifully appointed showrooms wherein may be seen an excellent display of electric light fittings and domestic electrical appliances. The general layout is planned to give visitors plenty to see and plenty of room in which to move about. In the basement there is a suite of model all-electric domestic offices—a kitchen, a scullery, and a bathroom. When the department had been feeling, for some time, the need for more room than the ground floor salons permitted, the idea of the strictly all-electric home was fast gaining in popular favour, and so the cellars below the showrooms were called into use with most remarkable effect.

One small but interesting feature of the kitchen is the "pence-meter" upon the wall—an ammeter marked in pence instead of kW, which shows upon its dial the actual cost per hour of running the particular appliance being demonstrated.

In the kitchen demonstrations are in daily progress, and periodical demonstrations of washing machines, &c., are carried out. The bathroom and scullery are fitted with thermal-storage water heaters, &c.

The undertaking exhibits regularly at the two-day Eastbourne flower show in August, during which cooking demonstrations are carried out.

The business-getting methods adopted by the undertaking embody considerable work in postal publicity, and about 500 circulars, &c., are distributed monthly.

Service to consumers is considered all-important, and special attention to all complaints and reports is promptly given. In the case of cookers, &c., spare parts are kept ready for replacement.

An indication of the growth of the domestic load in the area is the fact that at March 31st last the undertaking had on circuit 1,072 cookers, of which 102 were owned by the consumers. There were also 162 water heaters connected, and 24 each of wash boilers and washing machines. Cookers are now being hired out at the rate of about 50 per month. All new houses in this town are wired without exception.

In view of the marked improvements in electric cookers within the past year or so, the undertaking suggests that all cookers of recognised makes can now be depended upon for efficiency and to give reasonable life, and the undertaking is at present standardising on four well-known British makes. It is anticipated that the standard specification of the I.M.E.A. will be published shortly, the result of which should be that prices of the three sizes of standard cookers will be considerably reduced. There are about a dozen all-electric houses in the town, the costs of running which, with the low tariffs available, have proved to be very reasonable.

Mr. Brydges, borough electrical engineer, regrets that owing to very bad delivery of water heaters from British manufacturers, he has had to install some of foreign make.

## Brighton.

While Mr. John Christie, engineer and manager, Brighton electricity undertaking, is advocating the need for a large and up-to-date showroom with a frontage to one of the main thoroughfares in the central area of Brighton, the small showroom at present in North Road appears to have served excellently in connection with the undertaking's activities in the domestic supply field. The bulk of new business at Brighton is domestic lighting, heating, and cooking; in the Brighton area alone some 2,000 consumers a year are being connected and, as there are already some 21,000 out of a total of about 35,000 rateable premises connected, the undertaking has probably a greater percentage of possible consumers connected than any other undertaking in the country. In addition to this, there

is the adjoining borough of Hove, which is supplied in bulk; in this borough there are some 9,300 consumers.

The tariffs in Brighton for domestic supply are 4d. to 2d. per kWh for lighting and 1d. to ¾d. for other purposes. Under the lighting tariff on the sliding scale all large one-firm consumers owning hotels, multiple stores, &c., are allowed to group their accounts and get the fullest addvantage of the sliding scale.

The undertaking has just inaugurated a system of "assisted wiring" on simple hire-purchase principles which promises to be successful. The consumer is required to make an initial payment of 10 per cent. of the estimated cost of the installation, after which he pays 2½d. per kWh consumed, in addition to the ordinary charge, until a total of 160 kWh per point installed have been consumed, when the installation becomes the consumer's property.

Large-scale exhibitions have been run in the town at intervals of four or five years, and these have undoubtedly proved most successful; the good publicity afforded has been felt for quite a long time afterwards.

There is a capable staff of engineers, who keep in close touch with consumers and afford advice, free of charge, as to the most suitable lay-outs for installations.

Relations between the undertaking and the local electrical contractors are of the happiest character, and the two bodies work in close co-operation and help each other as far as possible. The undertaking does not compete with the contractors by selling apparatus, and it affords its consumers every facility for seeing the latest models of new apparatus, which they invariably purchase through their own contractors.

Several model all-electric houses have been put up on new estates in Brighton by building contractors, with a view to inducing purchasers of other houses on their estates to adopt generous systems of wiring for both lighting and power, with plenty of "outlets" where they are likely to be required.

**Overhead Services in Hastings Rural Area.**

### Hastings.

Some idea of the manner in which the domestic electricity supply problem is being tackled at Hastings may be gathered from the fact that during the last financial year the number of domestic appliances (other than lighting) connected to the mains, including cookers, fires, kettles, and so on, was increased from 6,668 to 7,822, an increase of 17 per cent. The domestic tariffs in vogue in the town of Hastings are 4d. to 3d. per kWh, on a sliding scale, for lighting, and ¾d. per kWh for other domestic purposes, flat rate in both instances. When an account exceeds £2 per annum meter rent is not charged. In the extended area the lighting rate varies from 8d. to 7d. per kWh, and the charge for heating and cooking, &c., is 1½d. per kWh. £3 is the limiting amount for meter rent in this case. Special favourable tariffs are granted for "off-peak" supplies, based upon the requirements of the borough electrical engineer, Mr. A. J. Ryan, M.I.E.E.

**Demonstration Kitchen in Eastbourne Showrooms.**

The business-getting methods of the undertaking involve chiefly showroom and demonstration work, and advantage is also taken of local exhibitions. The commodious showrooms in Hastings lend particularly well to demonstration work, which is carried on more or less continuously, especially in connection with cooking and water heating.

Very favourable terms are granted for the hire of all manner of domestic electrical appliances; for instance, a cooker of the Jackson No. 54 type, suitable for 6 persons, can be hired by a consumer in the borough of Hastings at 9s. per quarter, and a 2-kW fire of the Belling Bungalow type is available at 2s. per quarter. An extra 25 per cent. is charged in the extended area.

The department allows consumers to have under its hire-purchase schemes practically any type of electrical apparatus on payment of 20 per cent. (deposit) of the selling price of the article, the remainder being spread over up to three years in quarterly or monthly instalments. Wiring installations are also put in any suitable premises on payment of 20 per cent. (deposit) of the selling price, the remainder being provided for in a similar manner.

"Service to consumers" has always been a very strong point with the undertaking, and is quick and of the best.

The undertaking has its own installation department, but the greater part of the assisted-wiring work is carried out by the local members of the Electrical Contractors' Association. Relations with the electrical contractors are friendly and co-operative. Mr. Ryan considers that the demand for domestic electricity would be much greater if the prices of apparatus were lower, as practically all new consumers wish to use modern electrical appliances.

# The Eastbourne Convention.

J. Weston & Son] [Eastbourne.

**Headquarters, May 26th—31st.**

## Incorporated Municipal Electrical Association.

**No. 2.**—*Notes on technical developments in electricity supply and manufacturing in the Convention area, together with our first report of the Proceedings and of the Exhibition.*

### Electricity Supply at Eastbourne.

ELECTRICITY supply was first started at Eastbourne in 1881 by the Eastbourne Electric Light Co., and it is claimed that the town was the first on the South Coast to adopt public lighting by electricity, 22 Brush arc lamps being installed for illuminating the Parade in 1882.

Under the management of the I.M.E.A. president, Mr. J. K. Brydges, for the past 30 years, the undertaking has made excellent progress. In 1900, when he first took control of the undertaking, its plant capacity was 690 kW, and it served 516 consumers. To-day it has 10,250 kW of generating plant, and 12,500 consumers are connected to the mains. The station is equipped with modern turbine plant, and it has a thermal efficiency of 11.9 per cent. For the year ended March 31st last the maximum load on the station was 8,065 kW, and the load factor for the undertaking was 24.51 per cent. For the same year the undertaking made a net profit of £8,500.

**St. John's Road Sub-station, Eastbourne.**

The Eastbourne undertaking is now preparing in real earnest for its part in the national electricity supply scheme, under which it will cease to generate its electricity and take a supply from the Central Electricity Board. It is expected that the whole supply for the town and district will be available from the Board before the end of next year, although a partial supply has been arranged to be available by next autumn. A sub-station is being erected adjacent to the existing electricity works for supplying the town of Eastbourne and a large surrounding area. The C.E.B. supply at 132 kV will be brought to this sub-station and stepped down by two 20,000-kVA transformers to 11,000 V, from which pressure other transformers will step-up the supply to 33,000 V for transmission to the outlying districts.

The h.p. distribution system in Eastbourne is 2,200 V, single-phase, and this will be fed from the main sub-station by four 10,000-kVA banks of Scott-connected transformers, 3-phase to 2-phase, the existing single-phase feeders being balanced on the two-phase supply. A similar arrangement of Scott-connected transformers will be established at several e.h.p. sub-stations, which will also feed into the single-phase network, and these sub-stations in the town will be supplied from three 11,000-V, 3-phase, ring-main systems. A typical example of one of the sub-stations which will be used for this purpose is that at St. John's Road, which is at present equipped with five 11,000-V truck-type cubicles, a 2,200-V steel-plate cubicle switchboard, and two 500-kVA outdoor transformers. The above illustration of this sub-station depicts the care that has been taken not to allow the sub-stations to detract from the town's amenities.

Under the scheme outlined the whole of the present single-phase feeders and sub-stations will be utilised to the fullest possible extent, and all extensions which have been carried out during the last few years have been very carefully designed with this object in view.

A particularly interesting feature in connection with the work of the Eastbourne electricity undertaking is the specially designed decorative lighting along the front, for which credit is due to Mr. Brydges and his staff.

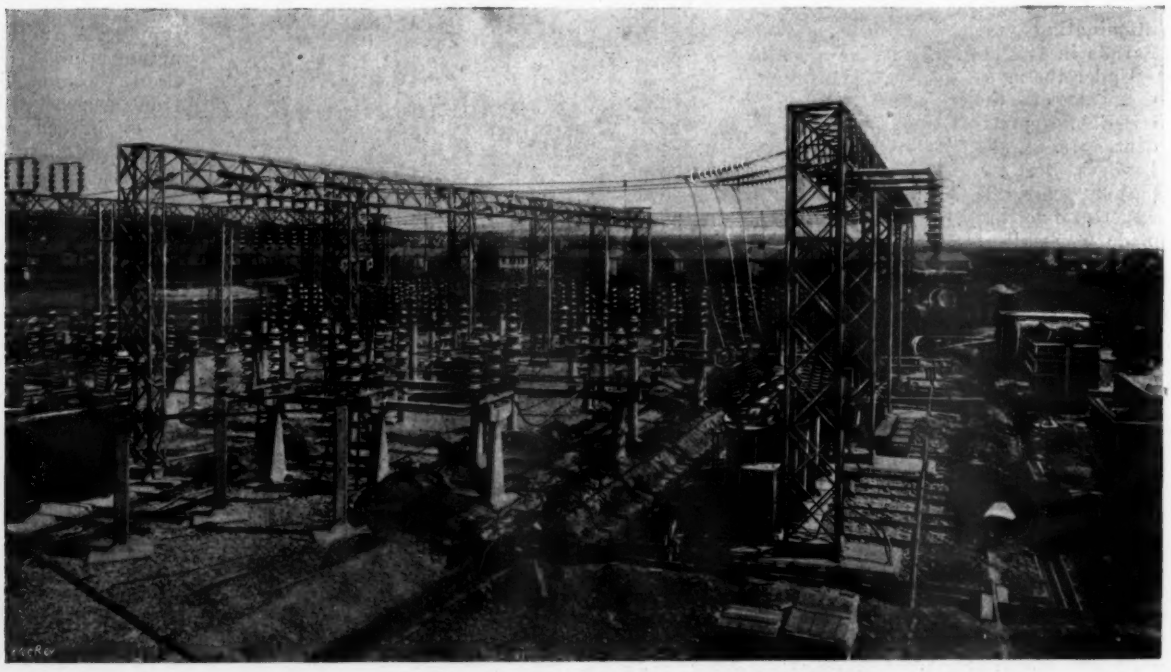
### Recent Developments at Brighton.

The "selection" by the Central Electricity Board of the Brighton Corporation electricity works in connection with the South-East England Scheme has resulted in the station becoming of outstanding importance in the S.E. Coast area. The present plant capacity of the station is 39,000 kW, 15,000 kW of which is represented by modern plant in one unit. This set, which was supplied and built by Messrs. Richardsons, Westgarth and Co., Ltd., in 1929, is of the Richardsons, Westgarth-Brown, Boveri design, and represents, it is claimed, the very latest achievement in high-economy steam-turbine design. It consists of a high-pressure cylinder with two single-stage impulse wheels followed by 12 rows of reaction blading, an intermediate-pressure cylinder of the pure-reaction type, and a double-flow reaction l.p. turbine with seven stages working in parallel. While the overall length of the machine is, of course, greater than that of a single-cylinder turbine, the total ground space occupied and the kilowatt output per sq. ft. of floor space compare favourably with larger units. Directly coupled to the turbine is an alternator of Messrs. Metropolitan-Vickers' design for an output of 15,625 kW at 0.8 p.f., three-phase, 50 cycles, 8,000 V, 3,000 r.p.m., together with the field-exciter and an air cooler. The turbine exhausts into twin contraflo-type condensers supplied by Messrs. Vickers-Armstrong.

**The New R.W. Turbo-alternator Set at Brighton.**

A further recent addition to the Brighton plant consists of two 75,000-lb. Yarrow water-tube boilers which work at 350 lb./sq. in., 600 deg. F. They are of the single-flow type and are equipped with Yarrow steel economisers and tubular air heaters, "L" type underfeed stokers, Davidson forced and induced-draught fans, and "Hydrojet"-type ash-removal plant by the Ash Co. (London), Ltd. An outstanding feature of the design is the provision of dust hoppers at every point of vantage in the gas path, these hoppers discharging in conjunction with the Ash Company's "Hydrojet" plant; thus, hoppers are placed between the boiler and the economiser, the economiser and the airheater, and the airheater and the induced-draught fan. An independent chimney is provided for each boiler, and also a natural-draught bye-pass, so that considerable loads can be carried without running the induced-draught fan. A noticeable feature is the direct discharge from the induced-draught fan upwards into the base plate of the overhead chimney, this arrangement reducing the fan power required for the given duty. The stoker drive is arranged under the firing floor, and consists of two motors, each of which is capable of driving the stokers of both boilers, thus giving 100 per cent. stand-by capacity.

The scheme of reconstruction carried out at the Southwick power station, under the supervision of Mr. John Christie, engineer and manager, provides for receiving or supplying in bulk from the South-East England section of the national scheme, and for this purpose three 10,000-kVA, 33,000/8,000-volt step-down or -up transformers, switchgear and cables have been provided. The main e.h.p. switchgear for the scheme has been supplied and erected by the Metropolitan-Vickers Electrical Co., Ltd. It consists of moulded stone cubicles, equipped with type "K5" remote electrically-operated oil circuit breakers erected in the switch room, and a vertical enamelled slate control board placed in the control room. The cubicles have duplicate sets of bus-bars, each capable of carrying 4,000 A continuously throughout its length. The oil circuit breakers are electrically operated by means of solenoids, and they are of massive construction because of the conditions under which they may be expected to operate.



**The Central Electricity Board's Sub-station at Brighton.**

### The Brighton Grid Sub-station.

The Brighton transforming station of the Central Electricity Board is of the low double bus-bar type, the bus-bars, 3-in. copper tube, and their isolating switches being supported on concrete stools, while the feeder isolating and earthing switches are carried above on steel structures; the cross-over connections are supported above the bus-bars between steel structures. The 132-kV transmission lines terminate at isolating switches, and earthing switches are incorporated in these terminal points. The line conductors each consist of a central stranded steel core surrounded by two layers of aluminium strands equivalent in electrical conductivity to 0.175-sq. in. copper.

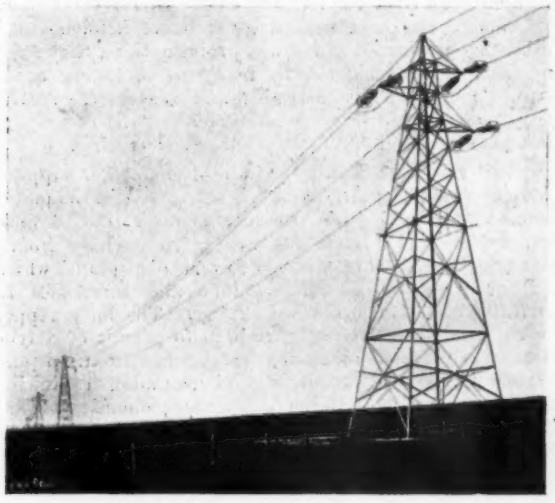
All the isolating and earthing switches are hand operated from the ground, but the mechanism is so arranged that the addition of motor operation by remote control can be readily carried out, if required, in the future. Each isolating switch consists of a moving arm at each end of which is fixed slotted phosphor-bronze spring contacts. The arm rotates horizontally about a vertical axis through its centre, and the contacts slide over the fixed V-shaped contacts of the switch, the apex of the V being the point of contact.

The oil circuit breakers each consist of three single-phase switches in separate tanks, with a common shaft operated by a solenoid, housed in the mechanism box at the end of each three-phase bank. Their rupturing capacity is one and a half million kVA, and the rated current-carrying capacity is 600 A. The bushings are of the oil-filled condenser type, and they contain the current transformers for instruments and protection. Oil-cleansing plant is housed in a special building.

The control gear for the electrically operated apparatus of the transforming station is housed in an auxiliary-plant building, and three-phase power at 400 volts is obtained from auxiliary transformers connected to the l.p. sides of the main power transformers.

The English Electric Co., Ltd., was the main contractor for the 132-kV switch and control gear.

The main power transformers (132/33 kV) are delta connected on the lower-voltage side and star connected on the 132-kV side, the neutral point being solidly earthed. They are self-cooled up to a predetermined load, and when the temperature reaches a given value the forced-cooling plant automatically comes into operation. The maximum capacity of the transformers under forced-cooling conditions is 30,000 kVA, and approximately 15,000 kVA on natural cooling. The transformers were supplied and erected by Messrs. Ferranti, Ltd. The mode of connecting the l.v. cables to the transformers is a distinct feature; instead of mounting cable boxes on the transformers, the cables terminate in sealing bells from which connection is made to the transformer terminals by tubular copper conductors supported on insulators and protected by steel screenwork. Tap changing for voltage control is carried out on the parallel-winding system for a range of plus and minus 10 per cent. from normal voltage.



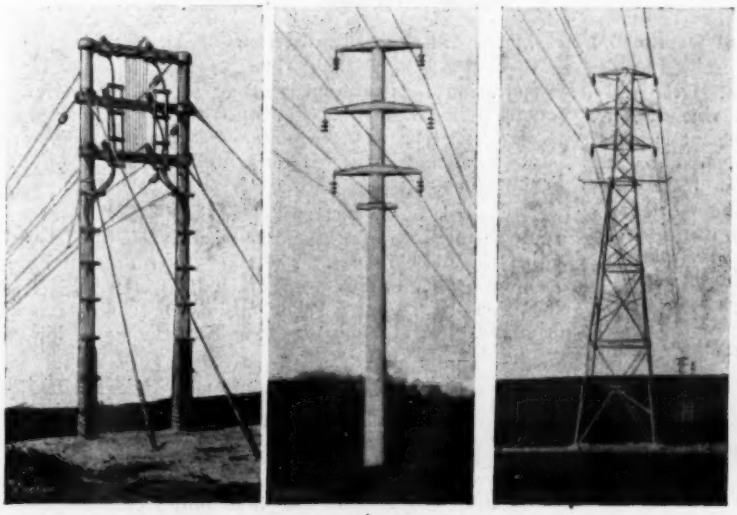
**132-kV Grid Line to Brighton Sub-station.**

The protective relays are situated on the relay boards in the control room in the auxiliary-plant house. The 33-kV distribution is controlled by ironclad switchgear of Messrs. Reyrolle's manufacture located in the auxiliary-plant house on the site. There are seven feeders, two of which supply the Worthing overhead lines, two the Hurstpierpoint overhead lines, and three connect the Brighton electricity station, *via*, three 10,000-kVA, 33/8-kV, B.T.-H. transformers in the power station yard.

Metering of both the incoming and outgoing supplies is carried out with special precision-type instrument transformers located in the main 8-kV switchgear.

### The Worthing Undertaking.

In the year 1922 the Corporation of Worthing obtained powers to extend the statutory area of electricity supply allotted to it in 1895 into the growing area immediately to the north-west of the town. A small single-phase system supplied by motor-driven alternators, at 3,300 V, 50 periods, was laid down, with distribution from kiosk sub-stations at 230 V. Shortly afterwards added areas to the west, north, and east of the borough were dealt with similarly. The new areas cover about 21,000 acres, and have a population of about 7,000. In developing supplies in a scattered district it is an advantage to have a few large consumers who may be regarded as the nuclei of sections of a distribution system, and in this instance the Corporation was fortunate in supplying at once three large hotels, a residential club, a social club, a convalescent home, a poor law institution, three water pumping stations, a brick and tile works, an isolation hospital, and the whole colony of High Salvington where a small local electricity supply company was bought out. The number of consumers supplied in the added areas at March 31st, 1930, was 1,800; the units sold amounted to 922,000, and the revenue obtained was £10,028. The e.h.p. cables are laid as a ring main looped in and out of twenty-one transformer kiosk sub-stations which reduce the 11-kV pressure to 400 V and 230 V for consumers' purposes. The sub-station capacities vary from 30 to 300 kVA. Underground work was selected



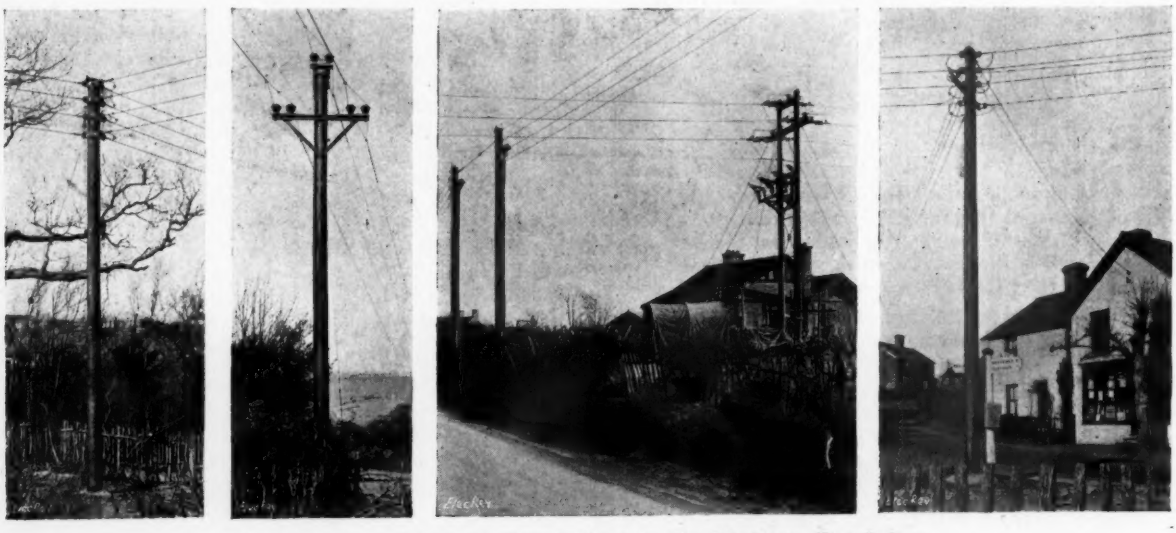
**33-kV Line to Worthing; Terminal, Concrete and Steel Poles.**

on account of the amenities of the northern part of the district supplied and the eventual urban character of the coast-line parishes.

The Corporation agreed that the tariffs outside the borough should not exceed those within the borough by more than 20 per cent. at any time, and this has resulted in a charge of 7d. for lighting and 1½d. for other uses. In view of the large capital expenditure involved in a risk, the outcome of which was problematical, the tariffs adopted were considered by many to be so low as to ensure a certain loss in trading. However, the results have proved contrary to that belief, and the ratepayers last year received £2,000 from the undertaking.

Until recently the whole of the 3-phase a.c. supplies were generated by the Diesel generating sets at the power station in Worthing. The advent of a limited bulk supply purchased from the Central Electricity Board has eased the demand upon the overloaded plant, which is now operated sometimes alone and sometimes in parallel with the purchased supply. The bulk supply has not been received long enough to permit of a true comparison of cost as between local generation and purchased energy, but there is good ground for thinking the former method to be the more economical. The charges levied by the Board are £2.5 per kW per annum, with an addition of 3.2 per cent. to cover losses en route, and 0.321d. per kWh delivered, with an increment of 5.8 per cent. to cover losses in transmission. Over and above these charges there is an annual line rental amounting to £9.04 per day. The arrangement is provisional, pending the Board commencing operations as a direct supplier. The energy is derived from the Brighton Corporation and is metered at the Worthing busbars at present. The transmission line consists of about 2½ miles of underground cable and five miles of double-circuit overhead line at the secondary pressure of 33 kV. The overhead lines are mounted on suspension insulators supported mainly by spun reinforced-concrete poles, which, it is believed, are the first of their kind to be erected in this country.

Owing to delay in securing purchased energy the undertaking has passed through a difficult winter, and Mr. Geoffrey Porter, M.Inst.C.E., has been forced to take steps to restrict the demand.



**Typical Examples of Overhead Lines in the Hastings Rural Area.**

### Progress at Hastings.

The public electricity supply in Hastings was commenced by the Hastings Electric Lighting Co. in 1882, when a generating station was erected at Earl Street by the late Mr. Robert Hammond. In 1899 the undertaking was purchased by the Hastings Corporation, and the system was then single-phase.

In 1925, when the Broomgrove power station (temporary selected) was completed, the system of generation was changed from single-phase to three-phase, and the periodicity altered from 100 to 50, the old single-phase feeders being fed by means of Scott-connected transformers. In 1926 a partial supply of three-phase current in bulk at 11,000 volts was given under agreement to the Bexhill Corporation. The Broomgrove power station and the necessary change-over arrangements were designed and carried out by Mr. Russell F. Ferguson, M.I.E.E., then borough electrical engineer, in conjunction with Mr. A. J. Ryan, M.I.E.E., then deputy borough electrical engineer.

In 1927 Mr. Ferguson resigned and was succeeded by Mr. Ryan, and since that time further rapid progress has been made; the kWh generated have increased from approximately 10,000,000 to 19,000,000, and the number of consumers from 8,125 to 13,500. Practically the whole of the supply to Bexhill is now given in bulk, and a very large extended area (150 sq. miles) has been taken in. The supply to the latter is by means of 22,000-volt underground cables and overhead lines, the low-pressure distribution being at 400 volts, 3-phase, with 230 volts to neutral. The supply was first given to consumers in Rye and Winchelsea in 1928, and this was followed in the same year by a supply to Battle; since then nine villages have also been connected. Up to the present 1,200 consumers have been connected in the extended area alone, over 500 of them being in the Borough of Rye. In addition, the Rye Corporation has changed from gas to electricity for its public lighting. For l.p. overhead work the undertaking uses "Aylesbury" poles, which, in most cases, are arranged for a 5th wire for public lighting switching.

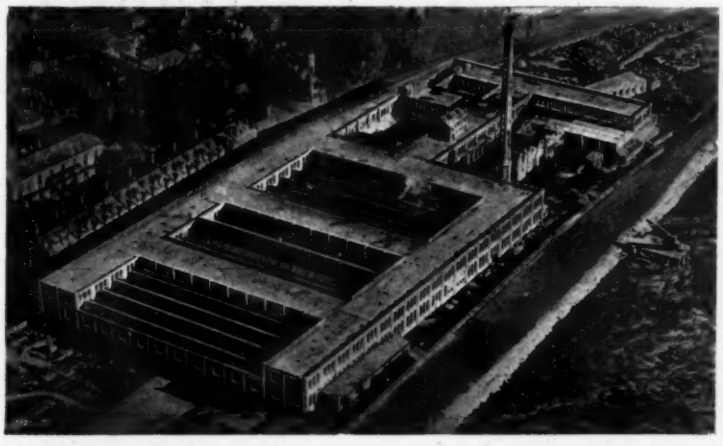
The single-phase network practically covers every street in the town of Hastings, and upwards of some 50 sub-stations are in use. The costs of production have been brought down to a very low level, the fuel consumption of 1.92 lb. per kWh (considering the load factor on the station, 21.9 per cent.) ranking among the lowest on the South Coast.

A recent extension at the station includes a Brush-Ljungström turbo-alternator, a feature of which is the new "Venturi" system of blading, a 30,000-lb. Stirling boiler, two "Premier" cooling towers, and ancillary plant. Two 0.25-sq. in. three-phase, 11,000-volt trunk feeders have also been laid from the power house to a sub-station in the centre of the town. For the l.p. distributors in the extended area the undertaking is using 5-core cable, 0.1 sq. in., with a 7/22 fifth wire for public lighting control. By this means the whole of the public lighting can be switched on from the sub-stations.

For the past three years it is anticipated that the undertaking will show gross and net profits of about £170,000 and £40,000, respectively.

### Pirelli-General Cable Works, Ltd.

During the last two years the works of Pirelli-General Cable Works, Ltd., on the Western Shore, Southampton, has been entirely remodeled and extended, while a new factory has been erected in Eastleigh. The Southampton works is devoted entirely to the manufacture of rubber-insulated cables and flexibles, cables of the compound-insulation class, and silk- and cotton-covered wire, while paper-insulated power, telegraph, and telephone cables are manufactured in the new Eastleigh works.



The Southampton Factory of Pirelli-General Cable Works, Ltd.

The Southampton factory is of commanding appearance, constructed of brick and reinforced-concrete, divided into thirty-one bays, and has a frontage of approximately 2,000 ft. As a matter of historical interest, it may be mentioned that the buildings are situated outside the old walls forming the original boundary of the ancient borough of Southampton on the north-western side. The Eastleigh works, which is claimed to be one of the most up-to-date factories in the kingdom, covers an area of approximately twenty acres, whilst a further twenty acres are devoted to a magnificent sports ground.

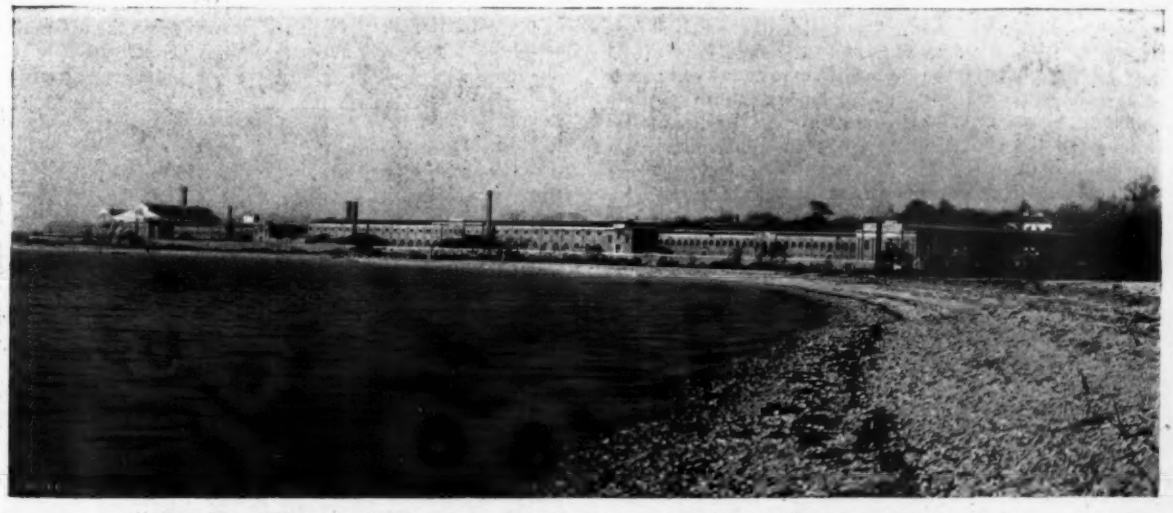
Of outstanding interest in the electrical world, and a result of the research policy of the organisation, is the introduction of the Pirelli oil-filled cable which may be manufactured and guaranteed for pressures as high as 220,000 V. It is significant to note that the only commercial installations in the world working at a pressure as high as 132,000 V employ this type of cable, and that at least two of these are capable of transmitting over 132,000 h.p. continuously. They are of special interest to-day in view of the fact that many miles of this type of cable are at present being installed in London for the Central Electricity Board.

With regard to overhead lines, Pirelli-General Cable Works, Ltd., amongst their important contracts, are erecting many miles of 132-kV line for the British grid system, including: part of the south-east England scheme, 254 route miles; the mid-east England scheme, 320 route miles; and part of the central England scheme, 18 route miles.

### Allen West & Co., Ltd.

When the firm of Allen West & Co., Ltd., was founded in 1910, with a factory on the present site at the foot of the South Downs on the outskirts of Brighton, the design of electric controllers for industrial purposes was in its infancy, and it was the lack of sound mechanical design at that period which gave the firm the opportunity to introduce control gear of a type more robust mechanically than anything then available. Many of the original drum controllers supplied by the company twenty years ago are still giving satisfactory service on cranes of all types throughout the world. At the same time Allen West commenced making liquid controllers for mine hoists and haulages, the first order received in 1910 being for six large reversing haulage controllers for a colliery in the North of England. These are still working satisfactorily after over five million operations each. Other classes of apparatus which have been developed in later years include automatic contactor control gear, oil-immersed high-pressure switchgear for power and sub-station control, and high-pressure outdoor overhead-line switchgear.

Recent orders secured by the Company include thirty complete equipments for underground sub-stations for the lighting of the City of Paris; for various mines in France and Belgium a number of distributing switchboards fitted with the type " DH " oil-immersed flame-proof metal-clad circuit breakers; an 11-panel switchboard for the Montataire generating station; a 16-panel switchboard for the Alsatian Potash Mines; and other switchboards for delivery to Holland (State Mines), Strasbourg, Siberia, South Africa, and Canada.



The New Factory at Woolston, Southampton, of Messrs. Allen West & Co., Ltd.

Although the floor space of the Company's factories at Brighton has been increased from 2,500 sq. ft., with twelve machine tools, in 1910 to 200,000 sq. ft., with over 1,000 machine tools, it is inadequate to deal with the increasing business. To meet the additional demand, the factory at Woolston, near Southampton, has been purchased, which has a total floor space of over 400,000 sq. ft., and will house many hundreds of machine tools, with the necessary shops, &c.

# The Exhibits at Eastbourne.

*Notes and illustrations relating to some of the principal items which are being displayed by manufacturers and representative organisations.*

As has been the case at each of the I.M.E.A. Conventions of recent years, there is again an excellent display at Eastbourne this year. There are forty odd companies and other organisations showing their wares, &c., and most of the exhibits, as usual, are domestic appliances. The following notes depict some of the more interesting items to be seen.

**New " Xcel " Water Heater.**

The principal feature of the stand of Messrs. Belling & Co. is the new No. 34 " Belling " cooker which is being shown for the first time and is attracting considerable interest. The oven has a clear cooking space of 12 in. wide by 13 in. high by 12 in. deep, and a loading of 2,000 watts. It is made in one piece with well-rounded corners, and is finished in vitreous enamel, inside and outside. The runners, shelves, and heating elements are all removable. A special type of ventilator is fitted at the back of the oven, allowing steam to escape without loss of heat. The oven attains, it is claimed, a temperature of 400 deg. F. in 20 minutes. The elements are of a new plug-in type, fitted top and bottom. The hob measures 22 in. by 17 in., and is finished in mottled-blue and white vitreous enamel. The inside of the hob is free from all electrical connections, and the simplicity of the method of wiring is one of the most commendable features of the cooker. The new totally enclosed boiling plate (7½ in. dia., 1,200 W) is made of a special alloy and is claimed to be a particularly fast and efficient plate. The boiler-griller is 8½ in. square and has a loading of 1,800 watts. This is similar in construction to the boiling plate, except that a special nickel-alloy sheet is fitted underneath, which, on becoming red hot, provides an excellent griller and toaster. A new and simple method of indicating the heat control has been adopted, and the wording on the switch panel is familiar to every housewife. A large warming cupboard is also included. The standard finish is blue and white mottled enamel, with white enamelled door panels. The vertical model is easily converted into a horizontal model, the oven door is easily reversible, and the switch panel can be fitted on either side of the splash plate, or on the wall as a separate unit. This cooker is suitable for four to six persons, and two other models on similar lines on show are suitable for two to three and three to four persons, respectively. A new series of three-heat enclosed-type boiling rings is being displayed on this stand.

Belling goods are also being displayed in some of the local electrical contractors' showrooms during the Convention.

Probably one of the last actions of the late Dr. S. Z. de Ferranti, F.R.S., was, during his tour in Switzerland, when his life was lamentably brought to a close, to purchase a small model electric cooker which he came across in a window display accidentally, and present it to the Electrical Association for Women. The model is featured on the stand of the E.A.W. at the I.M.E.A. Convention. It carries the inscription, " Presented to Miss Haslett for the Electrical Association for Women by Dr. S. Z. de Ferranti, F.R.S., January, 1930."

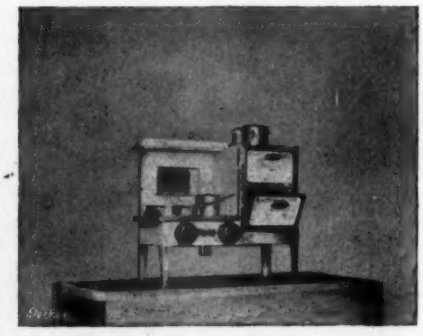
The display of Siemens Electric Lamps & Supplies, Ltd., includes a representative range of "Xcel" cookers fitted with high-efficiency " Xcel " enclosed boiling plates. The " Xcel Minor " is again an attractive feature as are also " Cosyglo " fires. The new series of " Homely " fires is also shown.

Water heating is represented on this stand by samples of the new " Xcel " hot-water storage tanks. These tanks have strong copper water cylinders, the inside surfaces of which are well tinned; they are subjected to pressure tests at the works. All the internal units, *i.e.*, the immersion heater, thermostat, and inlet and outlet pipes, are mounted on a strong, easily removable, gun-metal baseplate, so that cleaning is readily accomplished.

" Xcel " tubular heaters are also on view in a variety of finishes. This system of low-temperature heating is rapidly gaining favour, and it provides a very useful and reasonably constant load.

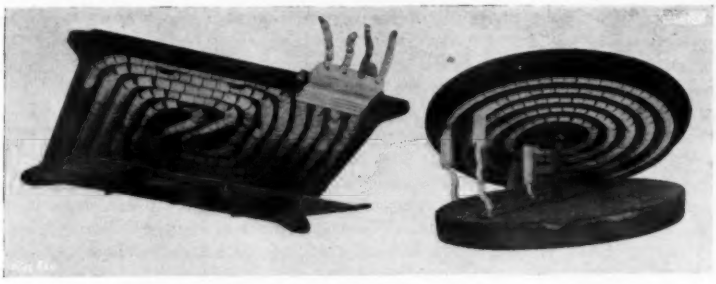
Messrs. A. Reyrolle & Co., Ltd., are showing a range of apparatus for the heating of water and other liquids, comprising a domestic water-heater, a steam-raiser, and immersion heaters, including two special arrangements of the latter, one being a bank of nine heaters for heavy-duty water-heating in factories, and the other a heater for raising the temperature of oil in oil-purifying equipments. The domestic water heater is one of the company's smaller sizes, 2½ gal., and is equipped with a 500-watt heating element, controlled by a thermostatic switch. The elements and thermostat can both be readily inspected, since they can be withdrawn from the cylinder without the water being drained away first.

The steam-raiser has a total capacity of 18 kW, and it will raise steam in 10 to 15 minutes, the pressure being 80 lb. per sq. in. The heating elements are built up of three 6-kW units, and the required selection is made by means of standard " Reyrolle " earthed plugs. Three sockets are provided, which are so arranged that either one, two or three units can be in circuit, giving 6, 12, or 18 kW, respectively. The fittings are nickel-plated, and the whole equipment is attractively finished in white enamel. The immersion heaters are of the tubular pattern, and are manufactured in units ranging from 0.75 to 6 kW capacity for use on circuits up to 500 volts a.c. or 250 volts d.c. The heating elements



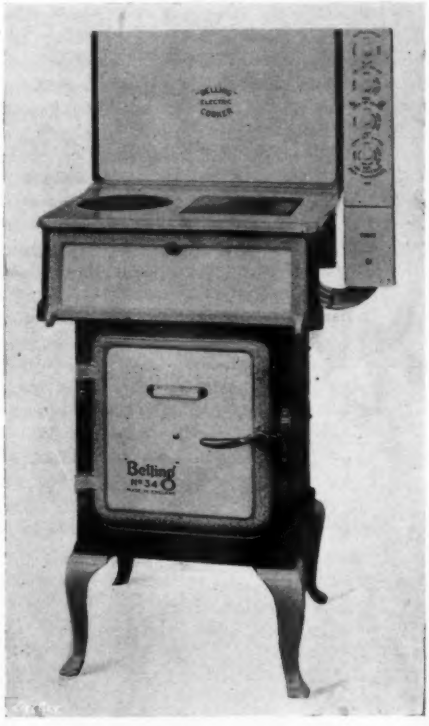
**This " toy " electric cooker was presented by the late Dr. S. Z. de Ferranti to the Electrical Association for Women.**

comprise spirals of high-grade. high-temperature, resistant wire, and are wound on special bobbin-shaped



**Construction of Boiling Plate for " Belling " Cooker.**

formers of refractory material which are themselves supported on a central metal rod. Inspection of the elements can be made without emptying the tank. Single- or three-phase heaters are available, each fitted with a standard earthed-metal-cased socket. Single-phase heaters can be provided with three-pin plugs and sockets having their pins disposed symmetrically 120 deg. apart, and, by a special wiring arrangement, any one of three different heats can be obtained by inserting the plug in one of the three positions.




**New " Belling " Cooker.**

The standard banks of immersion heaters are fitted with circular bus-bars, to which the incoming supply is connected, and terminals are provided on the bus-bars for connection to the single elements screwed into the common circular flange-plate. A sheet-metal protecting cap is provided to fit over the bus-bars. The sample shown is of 30-kW rating, and such units can be used in combination to provide for any desired loading.

The oil-heater shown is a 9-kW unit, and it is designed for use with oil-purifying equipment. It is in the form of an oil-tight box containing six 1½-kW immersion heaters, each fitted with a three-pin plug and socket for three-heat control. The use of multiple heaters provides a simple and efficient means of adjusting the temperature of the oil with varying loads.

An example of Messrs. Reyrolle's air-heating resistances is also being displayed. The resistance frames are mounted on a light angle-iron framework, and two terminals are provided at each end, so that a ready means is provided for connecting two or more frames in series or parallel as may be desired.

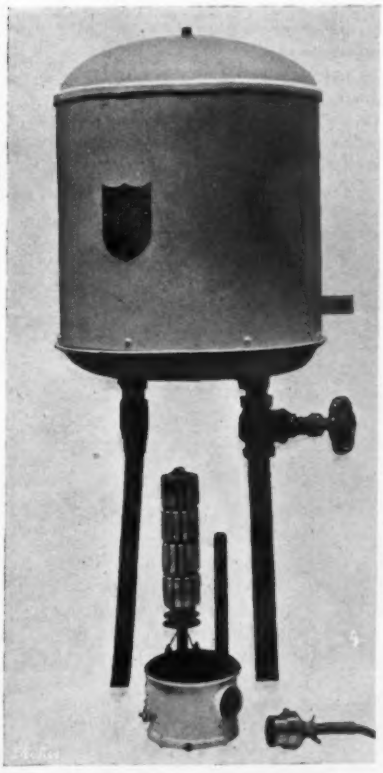
Another exhibit is a small electric drying-oven built up of sheet-metal to form two cases, one inside the other, and the space between the two cases and in the door is filled with an efficient heat-insulating material. Three heating elements are fitted in the base of the oven, and three-heat control is provided by means of a " Reyrolle " three-heat plug and socket. Two lifting-handles are provided to make the oven easily portable.

There are also on this stand a representative display of plugs and sockets manufactured to British Standard Specification No. 196 for 5-A, 15-A, and 30-A ratings, and a collection of small metal-clad, air-break switches for domestic and other purposes.

On the same stand, Messrs. Reyrolle's associated company, J. H. Holmes and Co., Ltd., is exhibiting a controller designed to give complete automatic push-button control of a.c commutator motors, such as those used for driving rotary-web newspaper printing presses. The pilot motor on the top of the controller is operated by means of push-buttons, which effect the operations of " inching," " speeding up," " slowing down," and " stopping."

A small reduction-gear box is fitted to the pilot motor, and four spindles protruding from this box transmit the energy from the motor for the necessary operations. The use of this controller makes it possible to alter the speed of an a.c. commutator motor of the brush-moving type from standstill to full speed, and in addition any desirable interlocks or safety features can be provided.

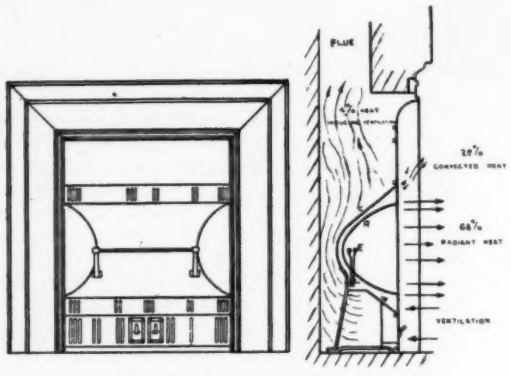
The Electric Lamp Manufacturers' Association is displaying a number of interesting exhibits bearing on the subjects of electrical advertising and shop lighting. This display is carried out in luminous surfaces representing the increased magnitude of the load taken by shops for successive years, and it is of particular interest to supply engineers, since it indicates the value of the shop-lighting load to the central station. Other displays include a fascinating coloured lighting display, incorporating a bronze model and a picture lighting demonstration, together with illuminated recesses, &c. Six vertical luminous columns in the interior are arranged to provide recesses for accommodating the displays, and these columns are designed on novel lines, so that a brilliant green surface is shown in direct contrast to a surface illuminated by red light, thus providing a unique lighting effect in the interior. One of the most interesting features of the stand is the miniature sign exhibit which is arranged on three panels to represent three windows looking out on a dull city area with drab buildings visible in the foreground. Another E.L.M.A. luminous display which is of considerable interest is that indicating the progress in shop lighting for a number of years.



**New " Reyrolle " Water Heater.**

In addition to stand No. 38 at the Exhibition

of the Convention, Messrs. Ferranti, Ltd., have taken showroom premises in Carlisle Road. At both of these centres there are displayed and demonstrated extensive ranges of Ferranti fires and water heaters, together with thermostats and relays of various types for off-peak control of thermal-storage equipment. In addition there are bell-ringing transformers and other similar small Ferranti appliances of domestic interest.




E, element; R, reflector; C, casing.

**Construction of the New " Ferranti " Fire.**

The well-known Ferranti fire, with its large chromium-plated parabolic reflector, is being shown in a range which includes a number of attractive new models with artistic wrought-iron stands of the dog pattern. Particular interest, however, is centred upon a new construction of the fire, which, when built into an ordinary flue, still delivers into the room, it is claimed, 96 per cent. of the heat generated in the elements, and utilises the remaining 4 per cent. for the purpose of ventilation sufficient to provide two changes of air per hour in a room measuring 15 ft. by 15 ft. by 8 ft.

On the stand of Credenda Conduits Co., Ltd., are staged examples of the latest types of " Creda " cookers, as hired by the Eastbourne and other undertakings. On two entirely new models plug-in elements are fitted throughout. There are also on show samples of the new " Creda " tubular heating system.

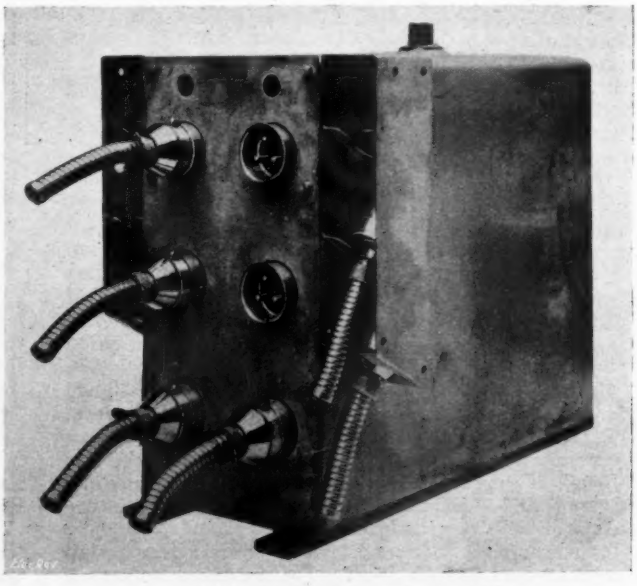
The most interesting feature of the display of Marco Refrigerators (1929), Ltd., is their 1930 range of " all-steel " refrigerators. These cabinets are constructed with a white cellulose-enamel exterior, and the linings are of one-piece steel, porcelain enamelled, with all corners rounded. Careful planning has resulted in the maximum of shelf space. The refrigerators are made in four sizes, and it is claimed that there is a model suitable for every class of home. The comprehensive range of " Marco " equipment is illustrated by a 75-cu. ft. sectional cold room operated by " Marco " equipment and fitted with the makers' new type cooling unit which, by virtue of radiation fins, allows for a quick reduction of temperature, while still retaining the advantage of the brine tank.

Of particular interest at the Exhibition are models of British Standard electric cookers (B.S.C.), which are the result of co-operation between the following manufacturers in producing standard cookers to the specification drawn up by the Electrical Apparatus Sub-Committee of the I.M.E.A. The companies referred to are Berry's Electric, Ltd.; the British Electric Transformer Co., Ltd.; Credenda Conduits Co., Ltd.; the Falkirk Iron Co., Ltd.; the General Electric Co., Ltd.; the Hotpoint Electric Appliance Co., Ltd.; the Jackson Electric Stove Co., Ltd.; Revo Electric Co., Ltd.; and Siemens Electric Lamps and Supplies, Ltd. A description of the B.S.C. cookers will be given later.

Among a range of domestic electrical appliances on show by the Manor Electric Oven & Fire Co. is to be seen a new cooker (No. 1273), suitable for four-six persons. This is fitted with one 1,800-watt combined grill and boiling plate, and one 900-watt boiling plate. The internal dimensions of the oven are 14 in. high × 12 in. × 14 in., and the loading of the oven is 1,800 watts. The elements are fitted one in each corner and are of the tubular type, approximately $1\frac{1}{8}$ in. in diameter, made up of steatite sections enclosed in rustless-steel tube. The cooker stands on four cast-iron feet 9 in. high, and it is fitted with a drop door to the plate-heating space. The hob, crown plate, oven interior and door panels are vitreously enamelled. A 10-gallon water heater of the non-lagged type is another " Manor " feature. It is fitted with four 750-watt immersion-type elements, and is made of tinned-copper, cellulose-finished outside, the cost of manufacture being claimed to be less than half that of the usual storage heater.

On the stand of Messrs. Chesterton Jones & Co., Ltd., a large cooker of attractive appearance is shown. This cooker has one rectangular and one circular hot plates, and a grill, loaded at, respectively, 1,600, 1,200 and 1,500 W. The enclosed-type hot plates are adjustable with the height of the top plate, and separately controlled by 3-heat switches. The grill is fitted on top of the hot cupboard, and is also 3-heat controlled. The hot plates are arranged to plug in, and the grill elements can be easily removed by slackening out three nuts. The oven elements are easily interchangeable, and the whole of the interior, including the inside door panel, is finished in mottled vitreous enamel.

A special feature of the general construction is the top cast support tray, upon which is maintained the hot plates and the grill. This tray forms a very neat finish to the top of the vitreous-enamelled sheet-steel sides, and makes it possible to dispense with screws passing through the enamel, which tend to cause chipping. There is also a small cooker on this stand, the overall size of which is 18 in. by 18 in. by 16 in. This cooker is of robust construction and finished with mottled-porcelain hob and sides, and a white-enamelled door plate. A special feature is the loose interior of the oven which can be easily withdrawn for cleaning purposes, without interfering in any way with the elements. The oven elements are arranged in a very efficient manner at the bottom, and are controlled by means of a rotary reciprocating-type switch. Special attention has been given to details of construction to make this cooker particularly suitable for hiring out purposes where appliances are subject to more or less rough handling.



**The " Reyrolle " Electric Oil Heater.**

The " David " iron, which is another noteworthy feature of this stand, is finished in mottled vitreous enamel and is a very attractive job.

*(To be continued.)*

# Report of Proceedings.

THE one uncertain factor in the prospect of an enjoyable stay at Eastbourne was the weather. However, although when the Convention office was opened last Monday morning in the gracious surroundings of Devonshire Park—the scene of most of the meetings and functions—it was raining, it became fine after noon, and good weather continued on Tuesday.

The first full gathering of members took place on Monday evening, when they were formally received by the president, Mr. J. K. Brydges, M.I.E.E. At the subsequent ball were fulfilled the promises one had heard so freely exchanged of late in places where engineers foregather—to meet again at Eastbourne.

The next morning was fully taken up with the engaging and most hospitable civic welcome, accorded by the Mayor of Eastbourne, Councillor Lt.-Col. Roland Gwynne; by the presidential address, in which Mr. Brydges showed himself to be one of those men to whom mature years form no barrier to the discriminating reception of new ideas; by a most appropriate paper on the obligations of electricity committees by Ald. R. S. CHATFIELD, chairman of the Eastbourne Electricity Committee; and by posing for the official photograph.

**Alderman R. S. Chatfield.**

The chief points in these and other addresses are commented upon in this week's leading pages, but a subsidiary point in Mr. Brydges's address, which gave it a touch of local colour, was his favourable reference to the proposed use on the Downs of lattice steel towers, which we must no longer call "pylons." On the other hand, visitors to the area to whom steel towers did not, any more than the Sussex windmills, appear to disfigure the landscape, were heard to express the hope that the same tolerance would not be extended towards the bungaloid growths which threaten to disfigure some other parts of the Downs. In Eastbourne, however, *meliora sequimur*.

*W. H. Winter]* *[Derby.*

**Mr. G. H. Lake.**

At the conclusion of the presidential address, the ladies took coffee with Mrs. Brydges in the tea room of the Winter Garden.

Tuesday afternoon was devoted to the official visit to the exhibition, a description of which is begun on another page, but we may here say that the exhibits included the first intimation of an attempt by British manufacturers to pool their experience in a standard design of electric cooker.

The evening's function was a reception by the Mayor of Eastbourne, supported by the Deputy Mayor (Alderman Miss A. Hudson), who kindly sent us the message for women visitors printed earlier in this issue. The reception was followed by a dance that proved as enjoyable as that on Monday night.

The paper on pulverised fuel by Mr. G. H. LAKE, with its discussion, provided enough fire to fill Wednesday morning's session at the Pavilion. The data given on the increase in steam capacity for a given floor space, and in the comparative efficiencies of boiler heating surfaces at Derby were certainly very striking, and, if there were criticisms of the author's strong opinions on the merits of pulverised fuel, they were no more than the importance of the subject deserved, or, indeed, than Mr. Lake asked for.

The afternoon's programme included a visit to the Brighton electricity works, providing an opportunity for seeing the Central Electricity Board's grid sub-station and high-voltage lines (described in another article to-day), followed by tea at the Royal Pavilion as guests of the Brighton Electricity Committee and Council. The evening was left free for informal conversazioni and reunions of a more intimate character than are possible at public functions.

Thursday's arrangements provided in the morning for a paper by Mr. J. W. BURR on the heating of buildings, followed by an informal discussion on domestic water heating, opened by Mr. A. E. MCKENZIE. It is evident that Mr. Burr has made a very close study of the subject, and he shows himself quite *au fait* with the examples of successful installations described recently in the technical Press, but, as he correctly points out, each case must be considered on its merits. An interesting side-light is thrown upon the manner in which an investigation into all the circumstances almost invariably improves the case for electricity. Mr. Burr admits that he himself was by no means convinced at the outset that electrical heating of the large building in question furnished the economic solution of his problem, but his doubts did not survive his investigations.

Mr. McKenzie's views on electric water heating carry additional weight from the fact that he carries his precepts into practice; in Wimbledon the fortunate consumer can buy three kWh for a penny for this service.

*Lafayette]* *[Manchester*

**Mr. J. W. Burr.**

Plans for the afternoon allowed for a visit by the Electrical Association for Women to the exhibition after a reception by the Deputy-Mayor and Mrs. Chatfield. Meanwhile the local authority committee members and the A.M.E.E. had arranged to hold their annual meetings. On Thursday evening the annual dinner was to be held at the Grand Hotel.

To-day's arrangements, apart from the I.M.E.A. Council meeting and the annual general meeting in the morning, include an afternoon visit by coach to Bexhill, Hastings, Winchelsea, and Rye, and tea in the Monastery Room in the last-named picturesque old

town. An invitation is extended to Convention members by Mr. R. Borlase Matthews to visit his 600-acre electric farm at East Grinstead on Friday and Saturday. The equipment on this farm is being modernised.

The agenda for to-morrow contains one item only, the visit to Eastbourne Electricity Works.

The reference to Eastbourne electricity works, which has been previously described in this journal (ELECTRICAL REVIEW, February 22nd, 1929), naturally leads us to think of the man who virtually created the Eastbourne undertaking as we know it to-day. Mr. JOHN KEMPE BRYDGES has occupied his position as Borough Electrical Engineer since November, 1899, but his wide and varied experience, before he settled down in surroundings which it would be difficult to imagine anyone desiring to leave, has prevented his outlook becoming limited to the boundaries of his town; this is made sufficiently obvious in his presidential address, an abstract of which is given below.

Mr. Brydges was born in 1868 at Cheltenham (a distinction he shares with the past-president, Mr. A. Nicholls Moore), and was educated at that fine school, Cheltenham College. He studied engineering at the Central Technical Institute, South Kensington, and later at King's College, London, of which he was elected an Associate.

In 1888 Mr. Brydges joined the Thomson-Houston Company at its Lynn (Mass.) works, and was occupied in establishing large electrical installations in many parts of the United States. After rather more than eight years' experience in America he returned to England, and became City Electrical Engineer at Wakefield, a position he occupied for 2½ years, when the call came to him to take charge of the undertaking which the Corporation of Eastbourne was purchasing from the local electric light company.

Mr. Brydges is a strong believer in cheap rates as the chief factor in promoting the use of electricity, evidence of which is to be found in the 0.5d. secondary rate for domestic purposes in Eastbourne. He has been a Member of the Institution of Electrical Engineers since 1890.

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# Presidential Address.

*(Abstract.)*

By J. K. BRYDGES, M.I.E.E.,
*Borough Electrical Engineer, County Borough of Eastbourne.*

FAR as we have progressed, we are still on the fringe of a wider field in which electricity is bound to find a premier place. There can be no shadow of doubt that, both nationally and economically, electricity is the force to which we must look in the future for all those industrial developments on which the country depends for its place in the sun.

We pride ourselves, not without reason, upon the conditions of our electrical developments to-day. But are we to take those lines as final? We have the machinery and we have the men, the brains, and the initiative and, up to a few years ago, we had the trade which is our very life's blood.

What we need more than anything else to enable us to regain our position in the forefront of nations is cheap energy and power. We shall not get it from the coalfields, even if the distressed miner gave his labour for nothing; but we can use him and his industry and, in the long run, restore what he has lost by a judicious blend of coal and electricity; in other words, bring about a happy condition of affairs resulting in the lowering of overhead costs. This is the black spot of British industry—the cost of production. Lower the cost of production within economic limits and the languishing flower of trade will raise its head like some garden bloom after a welcome shower of rain. Unless our industrial experts are entirely wrong, we shall bring this about through electricity, and this brings me to the main burden of my song—rationalisation.

*J. Weston & Son* [*Eastbourne.*

**Mr. J. K. Brydges, President, I.M.E.A.**

Like most long words with an imposing air of pomposity, it has a simple meaning when one examines it. After all, it is no more than a distribution of rations in properly organised circumstances. In our case it means the gathering together of all the electrical forces in the kingdom and distributing them to the greatest advantage among the industrial troops of the nation. In other words, a scientific preparation for the commercial war between nations which has been going on for the last two or three centuries and will continue so long as man has to obtain his daily bread by the sweat of his brow. So rationalisation is the thing of the moment. A gathering of everything that is potent in the field of electricity with a view to expending it to the best advantage, and thus obtaining the best results. There can be no question that the present overlapping of energy and power leads, not only to a good deal of unnecessary waste, but also to the expenditure of a good deal of unnecessary money. Rationalisation is the one economical end on which all parties in the State are agreed. They may differ on the application of the process, as they differed on the Coal Mines Bill, but, in essentials, they are one.

The Central Electricity Board was, therefore, created with the object of assimilating the generation of the whole country. It is only two years since the Act came into operation, and already schemes for six areas have been adopted, and one is under consideration, embracing 68 per cent. of Great Britain and 95 per cent. of the population; 116 stations have been selected and 340 will ultimately be closed down. It is estimated that the schemes will release about £10,000,000 represented by plant which has hitherto been more or less inefficiently employed. Contracts worth nearly £11,000,000 have already been placed; indeed, over two parts of the grid current has already been passed. It has been arranged to spend a similar sum on the standardisation of frequency, the Electricity Commissioners estimating that their six schemes will, in as many years of operation, reduce the cost of production by £11,000,000, which should be liquidated for the benefit of the public. Whether or not this is a sanguine estimate time only will show.

On the face of it, therefore, the promoters of this tremendous revolution appear to have good grounds for their

optimism. The scheme for rationalising supplies will, at a conservative estimate, involve an expenditure of something over £33,000,000, which sum will probably be covered by a Government loan. Already approximately £18,000,000 is the sum the Commissioners have consented to raise, the Board being entitled to ask for a Government guarantee for all the capital it needs. In May of last year the Board decided upon a preliminary issue of £3,000,000 and in January a further £7,000,000 without Government guarantee, which seems to show that the Board has the courage of its convictions.

Although the Commissioners seem to regard their scheme as being, in every way, economically sound and believe that very substantial savings will be effected by their various schemes, it is by no means certain that such sanguine estimates will materialise, at any rate not for some years to come. I am speaking now of the consumer, who is looking forward to the time when his light and power will cost him, on an average, a great deal less than they do at present. In time, no doubt, the new departure will be a boon and a blessing to man, but it seems as if that day is not likely to dawn just yet. The fact must be borne in mind that electric light and power are in this country still, to a certain extent, luxuries and certainly dearer here than in many other countries. If one reads the various Acts bearing on this subject carefully it looks as if the distributors, and not the consumers, will be the first to benefit from the lowering of costs. Capital charges (interest and sinking fund) have to be met until the plant taken over is paid for; in other words, consumers must meet these burdens, as they cannot be liquidated by any other means. It seems that we shall have to depend more and more, as time goes on, for the development of initial energy on the coalfields, without which it is impossible to regard electricity as a living organism. But enough, for the moment, of rationalisation. It is all in the lap of the future and we shall have to wait, with what patience we can, for the golden age which has been promised us.

Without being unduly pessimistic, I have felt it my duty to point out that there are yet many obstacles in the way of that electrical millennium which seems to have been confidently anticipated in more than one quarter. That we are progressing and that there are better times ahead for the consumer of electricity are beyond question. There are few of us here to-day actively engaged in municipal electrical enterprise who cannot point, with just pride, at their own achievements to that end during the last few years.

The opposition to the erection of lattice steel towers on the Sussex Downs has had powerful interests behind it. As was anticipated, there could be no deviation from the scheme as already laid down by those responsible for it. There is no getting away from the fact that, in an essentially commercial community like ours, the amenities of the countryside must occasionally suffer; deplorable no doubt, but there is no getting away from it. We cannot live in Arcadian simplicity and hold our own in trade conditions with the rest of the world unless we make some sacrifice, so far as the artistic side of life is concerned. Still, as the result of many protests by local authorities here and there, considerable alterations were made by the Central Electricity Board in the routes of the transmission lines originally laid out. Nor must it be forgotten that Eastbourne was not the only municipality in arms against the innovation of overhead lines. I venture to suggest that within the next year or two we shall have entirely forgotten that there are such things on the Sussex Downs as towers.

As regards secondary lines, alterations have also been made with a view of reducing their length in this county without any diminution of the service given therefrom. The amended scheme provides a double circuit line between Eastbourne and Newhaven, *via* Polegate, Hailsham, and Lewes. In respect of the secondary line from Brighton, the ring originally designed has been replaced by two lengths of duplicate lines from Brighton to Hurstpierpoint and from Three Bridges to East Grinstead and Horsham. The secondary lines have resulted in comprehensive schemes for distribution in areas hitherto unoccupied, or only partly so. Worthing is now receiving a supply from Brighton through a secondary line, a feature of which is the use of spun-reinforced concrete towers, which are the first example of this type to be used in the country.*

We are adopting a gigantic scheme of which few of us in this country have had working experience. One can foresee many obstacles; I am chary of piling up difficulties for the mere sake of what may sound like destructive criticism, but it is patent that these difficulties (mostly economic) will have to be faced and, in the long run, unless some quite unforeseen revolutionary change comes over the spirit of the dream, it would appear that the providing of cheaper electrical energy will remain in the hands of electricity supply authorities and their engineers.

The British Electrical Development Association, the British Electrical and Allied Industries Research Association, and the British Engineering Standards Association may be without the sphere of this address, but I cannot conclude without paying a brief tribute to the parts they have played in making our high standard what it is and what it is going to be in the future. Not forgetting, of course, the Electrical Association for Women. In evolution woman came after man and, as some anonymous cynical philosopher remarked, she has been after him ever since. Women are lining up with men to-day as colleagues and industrial equals, especially so far as our particular industry is concerned. We welcome them with both hands, for they have a sphere of usefulness which can only be indifferently filled by mere men. Students, domestic science teachers, and others will in due course go far and wide to preach the gospel of cheap electrical energy for household purposes, but there is yet another branch for the E.A.W. to which I see no allusion, and that is with regard to salesmanship. To-day most of our fittings, including domestic fires, are so refined and artistic that they must, of necessity, appeal to the artistic tastes which lie dormant in every woman. One can see a wide field in showroom and kitchen demonstration in which our women can play a wonderful part; indeed, they are already doing it.

* See page 1017 this issue.—EDS. ELEC. REV.

# Legal.

## Marconi Royalty Action.

IN the King's Bench Division on May 22nd, Mr. Justice Branson gave judgment in an action which had been brought by Marconi's Wireless Telegraph Co., Ltd., to recover £3,261 for royalties under a licence of May 6th, 1928, from a number of defendants. These were Mr. E. H. Newman and Mr. Maudslay Baynes, a firm, of Regent Street, W.; Mr. W. H. Cork, accountant, Eastcheap, E.C.; Mr. H. F. Gidden, 105, New Oxford Street; Mr. W. G. Adie, White Street, E.C.; Mr. A. W. White, Essex Street, W.C.; Mr. H. Bowyer, Bailey Mews; Mr. P. S. Booth, Kimberley House, Holborn; Mr. W. A. J. Osbourne, Magnet House, Kingsway; and Mr. L. O. Terrett, Charing Cross Road. All the defendants denied liability.

Sir Walter Schwabe, K.C., for the plaintiff company, said that the defendants were the inspector (Mr. Cork) and the inspection committee appointed under a deed of arrangement by the first two defendants, Newman and Baynes, who were in business together in the manufacture and sale of wireless sets and other apparatus under the style of "Langham Radio." Under the deed of arrangement mentioned, Mr. Cork and the committee of inspection proposed to carry on the business to a successful point.

Defendants' contention was that Newman and Baynes were still the licensees of the plaintiffs and they were carrying on the business under the control of Mr. Cork and the committee. The licence to Newman and Baynes had not been revoked, and had not been transferred to the inspector and the committee.

Giving judgment his Lordship said that he had come to the conclusion that the business remained under the control of Messrs. Newman and Baynes after the deed of arrangement had been made. The inspector and the inspection committee acted in strict accordance with the terms of the deed. His Lordship added that he was not satisfied that Mr. Cork and the committee knew that the sets involved the use of Marconi patents. The claim against them failed and must be dismissed with costs, but plaintiffs were entitled to judgment against Newman and Baynes with costs.

## Claim by the Irish Electricity Supply Board.

IN the Dublin High Court, on May 23rd. Mr. Justice Johnston delivered judgment in the action brought by the Irish Free State Electricity Supply Board against the Rathmines and Rathgar Urban District Council. The Board had acquired the Council's electricity undertaking last year and claimed a balance of £6,035 standing to the credit of the undertaking with the National Bank, Ltd. The Council maintained that the money had been appropriated in aid of the rates.

His LORDSHIP said that the wording of the Electricity Supply Act, 1927, regarding the acquisition of undertakings and their assets was quite clear. The Board took over the liabilities of the undertaking, and was entitled to receive all moneys standing to the undertaking's credit. He therefore gave judgment for the Board, but ordered each party to pay its own costs.

## The Responsibilities of Contractors.

BEFORE the Brighton Borough Bench on May 22nd, Mr. Herbert James Galliers, electrical contractor and a former Mayor of Brighton, was summoned for failing to provide a guard-rail and toe-board to protect workmen at a building in course of erection in Brighton. Thomas Frederick Collier, a workman, of Hove, said that whilst locating the position of an electric cable from the ground floor of the building he overbalanced and fell through a lift opening into the basement. Edward Warne, foreman electrician, said that he and Collier went to the opening to trace the position of the cable down from the first floor. Other contractors were working there, and Messrs. Galliers were not responsible for the lift opening.

Mr. DAVID MENZIES, H.M. Inspector of Factories (who prosecuted), stated that all contractors were responsible for the fencing of an opening to protect their own men.

Mr. C. B. GUTHRIE, for the defence, said that Mr. Galliers was defending this action because he felt that there was involved in the regulation a question of far-reaching importance to the electrical and entire building industry, and he was supported by the Electrical Contractors' Association. It was sug-

gested that under this regulation if one contractor on a building left an opening unguarded, every other contractor on the building was responsible because the original contractor had not done his duty, a responsibility which in some cases it would be impossible to discharge.

The Bench reserved its decision until June 7th.

### English Electric Co., Ltd.

In the Chancery Division on Monday last Mr. Justice Eve confirmed the reduction of the company's capital from £5,000,000 to £3,244,472. His Lordship said that it looked as though the reduction would give the company "a fair chance."

# Parliamentary News.

**[By our Special Parliamentary Reporter.]**

### Unemployment.

On May 19th, the Government majority fell to the narrow figure of 15 on the vote for the salary and expenses of Mr. J. H. Thomas, Lord Privy Seal. The debate resolved itself into an indictment of the Government for its handling of the unemployment problem. Mr. Thomas made a long speech defending his position, and said that the total amount sanctioned for relief works was £95,000,000, which would provide employment for 380,000 people for a year. It was difficult to give a precise statement of the average period of time which these works would take. He attached considerable importance to the North-Eastern Electricity Scheme, which was spread over a period of five years, but it was difficult to estimate any particular time when the maximum number of people would be employed on it. That applied to most of the schemes. The latest information showed that there were 100,000 people, directly and indirectly, employed at present on schemes sanctioned by the Government, independent of the railway schemes. The figure of £95,000,000 was partially distributed as follows: Classified roads, £26,000,000; unclassified, £3,000,000; railways, £19,000,000; electricity, £11,000,000; docks, £6,000,000; Colonial development, £5,000,000; sewerage, £4,000,000; water supply, £3,000,000; land reclamation and drainage, £1,000,000; sea defences, £250,000; and miscellaneous £2,000,000. All those items represented expenditure that would ultimately tend to make the nation more efficient. The expenditure on docks was directed to securing more efficient machinery; the expenditure on electricity was directed to giving cheaper power.

### Wirral Railway Electrification.

On May 20th, Mr. Thomas informed Mr. Graham White that the scheme for the electrification of the Wirral Railway was being reconsidered by the L.M.S. Railway Company.

### Domestic Heating.

On May 20th, in reply to Mr. Simon, Mr. Ben Turner, Secretary for Mines, said that the Department of Scientific and Industrial Research through the Fuel Research and Building Research organisations had carried out considerable investigation into the problems involved in the improvement of methods of domestic heating, and a number of reports had been published. As regarded eliminating the production of smoke, this was primarily a question of the use of electricity or smokeless fuels. Very extensive investigations had been carried out at the Fuel Research Station into the production of smokeless fuels, especially by improving methods of gas manufacture and the manufacture of coke suitable for domestic use. The best methods of heating in relation to any particular housing scheme depended so much on local conditions that it was not considered practicable at present to prepare a report which would contain practical recommendations suited to every case, but the Director of Fuel Research was always ready to give assistance and information to local authorities and others connected with such schemes.

### Railless Traction in London.

On May 21st, Mr. D. G. Somerville asked the Minister of Transport whether, in view of the supersession of fixed-rail tramways by railless traction in the London suburbs, he proposed to recommend to the London County Council the consideration of a similar substitution in its area; and whether there had been any entirely new systems of fixed-rail tramways established in this country in the last five years.

Mr. Morrison said that the answer to both questions was in the negative.

### Electric Traffic Signals.

On May 21st, Major Salmon asked the Minister of Transport what steps were being taken for the erection in the streets of London of electric traffic control signs.

Mr. H. Morrison said that it was proposed, subject to the concurrence of the local authorities, to make an experiment with electric traffic control signals in Oxford Street. The question of erecting such signals at certain road junctions in other parts of London was also under consideration.

Major Salmon then inquired if the signals in operation in the provinces had been successful, and whether there had been any decrease in the number of accidents since they were installed.

Mr. H. Morrison replied that he was advised that light signals of a proper type and properly placed at suitable junctions had facilitated the flow of traffic and had to some extent reduced the need for police officers on point duty. He had no information on which to form an opinion as to the effect of their installation on accidents.

# Correspondence.

*Correspondents should forward their communications* **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

### The Shannon Scheme.

With regard to the above article it is interesting to note that the Northern Government of Ireland, in promoting its Electricity Bill, has in view the changing of the large Belfast generating station into a super-station of the first order. It is intended to supply electrical energy from it all over the Northern Government's area, and to shut down all the other stations, municipal and privately-owned.

It is a magnificent gesture. But behind it there is something of tremendous importance to the mining and engineering industries. As a source of power, can coal beat water? Can the coal-driven station at Belfast beat the water-driven station at Limerick? Can the Northern Government enter into competition as a supplier of electrical energy with the Free State and beat it on results? The Northern Government experts believe it can. But they are careful not to say so too openly; for in the game which is now about to be played out in deadly earnest the idea, even, of competitive results has not entered. Each of the rival super-suppliers is apparently unconscious of the other's existence.

The Free State Ministry of Industry and Commerce has always shrouded all data and statistics relating to the Shannon scheme in a fog. Even experts have difficulty in penetrating to the inner mysteries. What is the exact position? Since the inception of the scheme the construction costs have multiplied themselves three-fold, and the cost to the consumer of the unit at his terminals has done even more.

Now here is a direct challenge to them! A challenge which they cannot ignore. They must come out into the light. For notwithstanding the nice discretion which one has become used to associating with the attitude of the Northern Government on any matter of ministerial function, it is quite clear that it is now on its mettle to burst the Shannon bubble.

Electricity and its applications is rapidly becoming a recognised feature in the education of the Irish people, not, it must be said, as an academic subject, but as an affair of the market place. It will take both time—and results—to get the ordinary man in the fields to readjust his ideas in comparative values. How something for which "good money" has to be paid can produce as good, if not better, results will bother him for some time. Coal has to be shipped from England to Belfast, and the bill for it will reach well over the one hundred thousand pounds limit, whilst the waters of the Shannon run wide and deep and very free.

In time we shall see, but in the meantime there is evidence on every side that the good wishes of many people in Ireland are with the Northern Government in the great task which it has taken in hand.

**P. T. W.**

*May 21st, 1930.*

### The B.E.A.M.A. and the Universities.

Professor W. Cramp, in view of his having taught Steinmetz's method since 1904, expresses surprise at the second paragraph of my letter in your issue dated May 16th. But that paragraph referred solely to "our great universities" whose obstinate adherence to bad teaching had hindered our mathematical progress "in the old times," just as it is now hindering our progress in electrical engineering. Professor Cramp does not claim to have taught Steinmetz's method at one of those universities, and he probably would not be allowed to do so. A professor at one of those universities has written to inform me that no amount of public ridicule will make him correct any errors in his teaching. I am afraid this sort of bull-dog pluck is peculiarly British, with the consequence that foreign universities are a good many years ahead of ours.

A more scientific spirit may prevail at Birmingham, where Professor Cramp is now teaching. I am surprised, however, at his having neglected some obvious opportunities of proving this. As he knows from the present discussion (or possibly from an article of mine that he saw about seven years ago), the conditions for a maximum value of $f(x)$ are that $f'(x)$ shall be

zero and that $f''(x)$ shall be negative *or a zero maximum*. The words here put in italics are my addition to the usual rule, and I have given a remarkably simple proof that they change it from a bad to a good one. If Professor Cramp had told us that he was teaching this rule at Birmingham, he would have shown that his university was here in advance of Oxford and Cambridge.

Again, he knows I have proved (in the *Journal of Scientific Instruments* dated November, 1927, and in the *Revue Générale de l'Electricité* dated May 12th, 1928) that the usual teaching with regard to electromagnetic induction is incorrect, and that the short-circuit force on a circuit-breaker crossbar is actually about twice as great as this teaching would lead us to expect. If he had said that his university has modified its teaching accordingly, he would thus have given further evidence of Birmingham's superiority over Oxford and Cambridge.

As the matter stands, however, I doubt whether the Birmingham students understand the algebra of complex numbers any better than the Oxford and Cambridge students do. According to the book to which Professor Cramp refers (written by himself and Dr. Smith), the symbol $j$ represents an "imaginary" number, as distinguished from positive and negative numbers, which are "real." This $j$ is said to have the peculiar property of satisfying the equation $x^2=-1$, from which Mr. Cramp concludes that $j=\sqrt{-1}$ (see p. 44). Here he makes one of the few mistakes that were made by Steinmetz. There are two numbers that satisfy the above quadratic equation, just as there are two numbers that satisfy $x^2=4$. Mr. Cramp cannot get over this difficulty by saying that he intended $\sqrt{-1}$ to represent these two numbers; for that would mean that $j$ is a double-valued number (like the $\pm 2$ that satisfies the last equation), and would thus be inconsistent with the way in which he himself uses $j$.

Even when this difficulty has been overcome, there remains the fact that the engineer cannot have confidence in results arrived at by juggling with a symbol that represents an impossibility. As a student, he may use this $j$ because he cannot otherwise obtain a degree at Professor Cramp's university. In his actual engineering work, he will naturally avoid the use of a symbol that admittedly does not represent anything real. As Professor Cramp remarks, the book here referred to was written in 1909. Possibly he has since heard about my way of making complex algebra a very simple matter to first-year students of electrical engineering. If so, and if he has adopted my method in his teaching at Birmingham, a public statement to this effect would give a further proof that Birmingham is outclassing Oxford and Cambridge.

**W. F. Dunton.**

Manchester, *May 25th*, 1930.

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It has been my lot during the last ten years to be in intimate association professionally with many University graduates, most of them picked men with honours degrees and other academic distinctions, and coming from nearly all the principal universities in this country.

In my experience they are, on the whole, distinctly weak in mathematical ability. The analysis of any but the simplest electrical circuits by means of either vector diagrams, the symbolic or any other method is painfully laborious to them. Moreover, never having learnt to use these tools efficiently, they soon forget how to use them at all. I am sure that Dr. Cramp need not hesitate as yet to teach the symbolic method for fear of its becoming too easy to them.

Undoubtedly university students have a tremendous lot to learn during their three or four years' education. Whether it is reasonable to expect a greater mathematical ability, and whether English university graduates compare unfavourably with their contemporaries in other countries in this respect, I cannot say. I do feel, however, that it would be worth while giving our university students more instruction and practice in the use of mathematical tools even at the expense of certain other items in the curriculum.

My remarks apply, of course, particularly to those students who intend taking up the more technical side of any branch of electrical engineering.

**E. T. Norris.**

Chorlton-cum-Hardy,
*May 24th*, 1930.

# Business and Industrial Notes.

**The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.**

## Merchandise Marks Inquiry.

The Standing Committee appointed by the Board of Trade under the Merchandise Marks Act, 1926, will hold an inquiry on July 7th and 8th, further meetings being held on July 14th and 15th if necessary, as to whether motor vehicles and parts should be required to bear an indication of origin upon importation into this country. Magnetos, batteries, and ignition plugs of all descriptions will be included in the scope of the inquiry.

## Australian Tariffs and Electrical Production.

The *Sydney Morning Herald* reports a recent speech by Dr. Earle Page, leader of the Australian Country Party, dealing with the Commonwealth's tariff policy. In the course of this Dr. Page quoted the case of the electrical industry to show how that policy had gone to extremes. He said: "For the benefit of one per cent. of factory employés who are engaged in this industry, duties are imposed which prevent the remaining 99 per cent. from having equipment that would enable them to have machinery which would create increased work and wealth. The high duties which keep electrical machinery from coming into Australia can only result to Australia's detriment. On electrical goods £1,260,000 duty was paid, equal to £260 in respect of every employé in the industry. In electrical manufacturing in Australia the value added in process of manufacture is only £296 per employé per annum. However, to obtain this, the community paid £199 in wages to each employé, and paid an additional £260 per employé in Customs duties. It looks as if the country is £163 to the bad in respect of every employé, and there are 4,872 of them. Our engineering and electrical duties return some £5,000,000 a year. Many of the items of these schedules have never been used to develop Australian industry, but to impede it. At the present time Great Britain is realising the necessity for practical consummation of the ideal of Imperial economic unity to enable it to successfully encounter the competition of the United States of America and Western and Central Europe. Why should we not say frankly to Great Britain that we are prepared immediately to give her absolute free trade in all those articles in the engineering and electrical lines in which we are not able to supply the whole Australian market, and if it is necessary to maintain smaller industries, to assist them by a bounty rather than a duty?"

## W. & T. Avery's Bi-centenary.

Extensive preparations are being made to celebrate the bi-centenary of Messrs. W. & T. Avery, Ltd., the Birmingham manufacturers of weighing and testing appliances. The commemoration will extend over several days at the beginning of July, and many people prominent in industrial, commercial, professional and political circles have already promised to attend. The growth of the firm of Avery has been one of the romances of industry. Originating in a small steelyard-maker's shop at No. 11, Digbeth, Birmingham, opened in 1730 by a Mr. Ford, the business has grown steadily until to-day the company is known throughout the world.

## Radio Manufacturing in Australia.

An extensive new site and buildings have been purchased by Amalgamated Wireless (Australasia), Ltd., for the development of the company's manufacturing activities. The new plant, which is about five miles from Sydney, will be devoted largely to the production of receiving sets. This company, in which the Australian Government has invested £500,000, has supplied complete radio transmitting and receiving stations to New Zealand, East Africa, China, Japan, the Pacific Islands, and other countries. It has also designed and supplied most of the broadcasting stations in Australia.

## The Protection of Traders.

The principal subject discussed at the annual meeting of the National Association of Trade Protection Societies, held in London last week, was the registration of Court judgments. Mr. H. S. Haworth pointed out that while, under existing conditions, County Court judgments against debtors for over £10 were registered if not satisfied within 21 days, no such registration prevailed with regard to unsatisfied judgments in the High Court and certain other courts, even when very large amounts were involved. He pressed for the setting up of a commission by the Lord Chancellor to consider this question. Mr. J. E. Hallmark said that judgments were often obtained by persons or firms connected with a debtor and these were used to shield the debtor against claims by other suppliers. Mr. W. A. Clarke moved a resolution demanding that limited companies should be given votes in municipal elections as they were ratepayers and should have a voice in local affairs.

## Employment during April.

The *Ministry of Labour Gazette* for May says that employment in the engineering industry during April continued bad on the whole and showed a further decline, especially in the North-Eastern and North-Western divisions. In electrical and railway engineering employment was fair, but at the end of the month Saturday work was discontinued at a number of railway engineering establishments. Employment in electrical engineering continued moderate in the Birmingham, Wolverhampton and Coventry districts, and it was good in London and the southern counties. There was an increase of 5,628 in the number of unemployed in the engineering industry, raising the total to 126,501, and the proportion to 12.6 per cent. (against 12.0 per cent.). In the electrical engineering section the number of unemployed rose to 5,546, the proportion rising from 6.0 to 6.6 per cent. The number out of work in the electrical wiring and contracting industry also increased, the total being 1,681 and the proportion 10.1 per cent. (against 9.2 per cent.). In the electric cable, wire and lamp manufacturing group employment also declined; the number of unemployed increased to 7,630, raising the proportion from 7.8 to 8.1 per cent

## Social Events.

The final round for the Ferranti Challenge Cup and gold medals, presented for competition by Mrs. Ogden, of Hollinwood, was contested by Ferguson, Pailin, of Higher Openshaw, Manchester, and Ferguson, Shiers, of the Rubber Works, Manchester, at the Ferranti sports ground, Hollinwood. The game resulted in a decisive win for Ferguson, Pailin, the result being six goals to one. During the whole of the competition only one goal was scored against the cup winners, the number being 14 goals for and 1 against.

At the annual display by the pupils of the Dorelle School of Dancing, London, held at Trinity Hall, Hounslow, on May 16th, one of the items in the programme was a ballet introducing well-known advertisements. Amongst them was a representation of Siemens "Popular Pair," and the children in this tableau were dressed as they appear on the well-known poster. The girl carried a dummy Siemens "Pearl" lamp and the boy a dummy "Silvalux Opal" lamp.

The first of the G.E.C. inter-works cricket matches of the season took place on May 17th, when the Magnet House (London) eleven visited the G.E.C. Coventry works and scored an eight-wicket win.

## Book Notices.

South African Mining and Engineering Year Book, 1930. Price £1 1s. Rhodesian Mining and Engineering Year Book, 1930. Price 10s. 6d. London: Argus South African Newspapers, Ltd.—The latest editions of these year books, as in preceding years, include a number of sections which will probably be of interest and use to electrical exporters who do business with South Africa and Rhodesia. All phases of municipal activity are dealt with, the business of electricity supply receiving ample treatment. The electrical section includes a table of electricity undertakings giving full particulars of plant installed, system and voltage, &c., in municipal power stations.

"Kelly's Directory of the Merchants, Manufacturers, and Shippers of the World." Two vols. (pp. 4,690). London: Kelly's Directories, Ltd. Price 64s., post free.—This is the 44th edition of the directory, which in addition to comprising more than a million and a half names, in over 20,000 places, is a gazetteer, and contains all manner of facts and figures of value to the business man. The publication covers the whole world, and is fully indexed in four languages. Reference is facilitated by a concise explanation of the arrangement of the matter, a new feature being an index to trades by which it is possible to trace by consulting the index once only those firms throughout the world which deal in a particular branch of commerce.

"Economy in Production," by W. B. Challen (Messrs. Taylor & Challen, Ltd.). (7 pp., abridged.) London: The Institution of Mechanical Engineers. This is a reprint from the Institution's *Proceedings* of an address given by the author as chairman of the Midland Branch. It deals with methods employed in modern press-work and quotes a number of notable examples of machines used in this country and abroad.

The Summer Number of *Punch* (1s.) is, as usual, colourful and cheerful. The drawings include yet another libel on Aberdeen, and a very funny study by H. M. Bateman of "The Man Who Paid Off His Overdraft."

"Electrical Distribution Engineering," by N. P. Seelye. Pp. viii+710; figs. 394. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

"The Compulsory Taking of Land," by T. Waghorn. Third and enlarged edition. Pp. xi+134. London: Effingham Wilson. Price 5s.

## Trade Announcements.

The business of Messrs. Thomas Beeley & Son, Ltd., has been taken over by Messrs. Joseph Adamson & Co., P.O. Box 4, Hyde.

Wild-Barfield Electric Furnaces, Ltd., informs us that its licensees for France, Switzerland, and the Netherlands, La Compagnie Française "Wild-Barfield," has recently taken extensive new premises at 110, Avenue du Général Michel Bizot, Paris. A full range of Wild-Barfield furnaces will be manufactured at, and sold from, these works.

The title of the Wholesale Electric Lamp Co., Ltd., 37, Vauxhall Bridge Road, S.W.1, has been altered to the Wholesale Electric Co., Ltd. The change of name does not affect the business of the company in any way.

The business hitherto carried on by Messrs. F. E. Pawson and C. A. Pawson under the name of George Emmott at Wadsworth Mills, Oxenhope, has been converted into a private limited liability company under the title of George Emmott (Pawsons), Ltd.

The General Electric Co., Ltd., announces that its branch address at Aberdeen has been changed from 30, Adelphi, to Magnet House, 32, Market Street. The telephone number and telegraphic address remain unchanged.

New premises are being opened on June 1st at 46, West Register Street, Edinburgh, by the Holland House Electrical Co., Ltd., which will supply the electrical contracting trade.

The British Resistor Co., Ltd., announces that it has moved its organisation from Halifax to Trafford Park, Manchester.

The Lea Recorder Co., Ltd., announces that it has opened an office in London at Parliament Mansions, Orchard Street, Victoria Street, S.W.1. (Telephone: Victoria 0984.)

Mr. Vincent Jackson, electrical contractor, is shortly opening new premises at 81, St. James Street, Liverpool, and asks for manufacturers' catalogues, &c.

## Bankruptcy Proceedings.

S. E. Richards and A. K. Richards, trading as Richards and Neilson, radio and electrical engineers, 182, Tulse Hill, S.W.—The first meeting of creditors under this failure was held on May 16 at Carey Street, W.C.2, when accounts were presented showing liabilities of £554 and no available assets. The Court had already made an order for the summary administration of the estate, and the matter remains in the hands of the Official Receiver as trustee. The principal creditors are:

| | £ | | £ |
|---|---|---|---|
| General Electric Co., Ltd. ... ... ... ... | 35 | V. F. Lyon (deceased) | 350 |
| | | Sun Electrical Co., Ltd. | 132 |

E. Ball, Old Hall Street, Middleton, Lancs., electrical contractor.—At the recent public examination of this debtor at Oldham a statement of affairs was produced showing ranking liabilities of £768 and a deficiency of £605. The debtor attributed his failure to loss on contracts, bad debts, legal costs on summonses, heavy wages bill, and domestic illness. The hearing was adjourned.

E. Doudney, 93, East Street, Chichester, radio dealer.—The public examination of this debtor was held on May 21st at Brighton. The statement of affairs showed liabilities of £2,428 and assets of £350, leaving a deficiency of £2,078. The debtor attributed his failure to bad trade, competition, and ill-health, and the examination was adjourned.

B. L. Cox, Shirland Street, Chesterfield, electrical engineer.—The public examination of this debtor was held on May 16th at Chesterfield. The debtor attributed his deficiency of £858 to bad trade, an unprofitable agency in batteries, and to heavy trade expenses. The examination was closed.

J. G. Wadsworth (Nene Road Electrical Co.), electrical engineer and motor accessories dealer, 10, Westfield Terrace, Higham Ferrers.—First meeting held May 28th at the Official Receiver's offices, 6, The Parade, Northampton; public examination, June 6th, at the County Hall, Northampton.

E. F. Lee (F. Newton), electrical engineer, 340a, King's Road, Chelsea, S.W.3.—Application for discharge to be heard at Carey Street on June 20th.

L. F. Coller (J. and F. Coller), electrical engineer, 63, Henton Road, Leicester.—Last day for proofs for dividend, June 4th. Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester.

W. H. Thornton, electrical and wireless engineer, 25, Bridge Street, Burnley.—First and final dividend of 4½d. in the £ payable at the Official Receiver's office, District Bank Chambers, Blackburn.

H. Gartside (H. Taylor & Co.), electrician and wireless dealer, The Arcade, Waterfoot.—First meeting held May 30th: public examination, July 4th, at the County Court Buildings, Rochdale.

W. M. HORSFALL, electrical engineer, 7, Red Cross Street, Liverpool.—Last day for proofs for dividend, June 7th. Trustee, Mr. J. Allcorn, Official Receiver, Government Buildings, Victoria Street, Liverpool.

## Company Liquidations.

FARADEX-SERAPHONE CO., LTD., 18, Bolton Street, W.—Under the compulsory liquidation of this company the accounts show liabilities of £12,892, against assets of £2,107, leaving a deficiency of £54,992 with regard to contributories, the issued capital being 1,067,357 ordinary shares of 2s. each. The Official Receiver reports that the company was formed in April last year to take over the goodwill and assets of Rooke Bros., Ltd., manufacturers of radio receivers, and of Seraphone Co., Ltd., manufacturers of radio sets and gramophones. The consideration payable to Rooke Bros., Ltd., was £15,000 in cash and £25,000 in shares, while the Seraphone Co. was to receive £5,000 in cash and £10,000 in shares. Except for £2,000 paid to Rooke Bros. no part of the cash consideration had been paid, but the shares were allotted. On April 27th, 1929, the company made a public offer of 750,000 shares of 2s. each, but only 69,065 shares were applied for; 15,000 shares were taken by the directors for qualification purposes; and the balance (665,935 shares) was left with the underwriters and sub-underwriters. With one exception the latter had failed to pay for the shares for which they were liable. The company acquired a lease of premises, but it never commenced business; the agreements with the vendors were not completed, and as a result the vendors did not transfer the property. The position of the company is attributed to the failure of the sub-underwriters to fulfil their obligations. The Official Receiver agrees with this but says that the directors were responsible for the position in placing the underwriting with a company which had a paid-up capital of only 2s. Moreover, with one exception, the directors failed to pay anything in respect of their qualification shares. Mr. Kenneth A. Layton-Bennett has been appointed liquidator, with a committee of inspection.

BOWYER-LOWE CO., LTD., radio apparatus manufacturers, Letchworth.—A winding-up order was made against this company on April 14th on a creditor's petition. On May 20th the statutory meetings of creditors and shareholders were held at Carey Street. Mr. H. P. Naunton, Assistant Official Receiver, who presided, said that the company was incorporated in 1922 to acquire a partnership business carried on by Messrs. A. E. Bowyer-Lowe and H. W. Widgery. The original capital was £800, but it had been increased and amounted to £5,700 at the date of the order, of which £5,200 had been issued. The company was successful for some time, but a removal to a new factory in 1927 disorganised the business. It had also been affected by a falling-off in trade and by the necessity for providing plant in excess of requirements to enable prompt delivery to be made. The company, in 1928, became interested in Recordaphones, Ltd., but the latter failed to secure a demand for its instruments and it provided the Bowyer-Lowe Co. with £12,500 in order that its holding in that company might yield a better return. On February 7th last, however, the debenture holders of Bowyer-Lowe Co. appointed a receiver who accepted an offer of £6,000 for the assets, which Mr. Bowyer-Lowe considered an inadequate sum. The company's gross liabilities had been estimated at £22,750. Mr. Bowyer-Lowe estimated the assets at £13,580, but in the opinion of the Assistant Official Receiver that figure was too high. Mr. F. E. Bendall (Poppleton and Appleby), Birmingham, was appointed liquidator, with a committee of inspection consisting of representatives of Marconi's, the Edison Swan Electric Co., Ltd., and the Mullard Wireless Service Co., Ltd.

CHUBBS AUTOMATIC MANUFACTURING CO., LTD.—At a recent statutory meeting of creditors the appointment of Mr. P. J. Chaplin, 8, Staple Inn, W.C.1, as liquidator was confirmed. An approximate statement of affairs as at March 22nd shows total liabilities of £15,000 (partly secured) and a deficiency as regards unsecured creditors of £9,722.

KINGS INVENTIONS (ELECTRIC), LTD.—A meeting of the creditors was to be held at the offices of Messrs. Hannay, Horton and Cook, 41, Castle Street, Liverpool, on May 28th.

## Private Arrangements.

J. HILLER, 52, Whitechapel Road, E.1, electrical and radio expert.—A meeting of creditors was held on May 16th at the offices of Mr. James Mortimer, 12, Coleman Street, E.C., when the representative of the Marconiphone Co., Ltd., the largest creditor, presided. The statement of affairs submitted showed liabilities of £1,115, of which £982 was due to the trade, and net assets of £198, leaving a deficiency of £917. The debtor made an offer to his creditors of 2s. 6d. in the £, to be paid within a month, and the creditors decided to accept this offer The following are the principal creditors:

| | £ | | £ |
|---|---|---|---|
| Burndept Wireless (1928), Ltd. ... ... ... ... | 177 | Marconiphone Co., Ltd. | 300 |
| | | Philips Lamps, Ltd. ... | 98 |

RICHARD DRING, radio and electrical engineer, 257, Freeman Street, Grimsby, and High Street, Cleethorpes.—The creditors interested herein met recently at Grimsby, when a statement of affairs was submitted which showed ranking liabilities of £2,478, of which £1,882 was due to the trade, and net assets of £1,416, leaving a deficiency of £1,062, which was attributed to depreciation written off the assets and loss on trading. A deed of assignment had already been executed in favour of Mr. A. G. Pearson, accountant, Grimsby, and the creditors decided that the estate should be realised under the deed. A committee was also appointed consisting of the representatives of Messrs. T. R. Beadle & Co., Ltd., the Northern Electrical Co., Ltd., and Poppleton, Appleby & Turner. The trustee stated that he hoped to dispose of the business as a going concern.

H. & R. W. FAIRFIELD, trading as Fairfield & Co., London Road, Leicester, wireless dealers, &c.—At a recent meeting a statement of affairs was submitted which showed ranking liabilities of £5,143 and net assets of £2,347, leaving a deficiency of £2,796. The deficiency was attributed to losses on trading and the depreciation written off the assets in the statement of affairs. No offer of a composition was made, and it was decided that a committee should be appointed to consider the matter and to make recommendations to the general body of creditors.

## Dissolution of Partnership.

HILDER & BOGGIS, motor, wireless, and electrical engineers, 22, Sackville Road and Victoria Works, Victoria Road, Bexhill-on-Sea.—Mr. E. A. G. Hilder and Mr. F. A. Boggis have dissolved partnership. Mr. Boggis will attend to debts and continue the business.

## Deed of Assignment.

C. SEYMOUR (Weston Electric Lamp Co.), electric lamp factor, 47, Victoria Street, S.W.—Particulars of claims by June 6th to the trustees, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., and S. Sharpe, Balfour House, Finsbury Pavement, E.C.

## British Capital in Greece.

The Athens correspondent of the *Daily Telegraph* reports that an important transaction was concluded on May 22nd between Messrs. Pearson & Co. and the General Hellenic Company, controlled by a syndicate of Greek banks and the Prudential Assurance Co., under which the control of the production and distribution of the electric light and power and the motor-'bus services in the whole area of Athens, Piræus, and suburbs will be placed under British control. The Power and Traction Finance Company obtained five years ago a contract for this business, and with a capital of £700,000 and £2,000,000 borrowed under the Trade Facilities Act guarantee, has carried out the greater part of the works. The amount provided, however, was insufficient to cover the whole undertaking, and difficulties were experienced in obtaining further capital as the majority of the shares was in Greek and French hands. Pearson & Co., co-operating with the Prudential Assurance Co., have now bought all the shares owned by the French group and the greater part of those owned by the National Bank of Greece, and now hold 620,000 shares out of the total of 700,000. It is said that the British group will provide £800,000 to £1,000,000 for the completion of the Athens-Kifissia Electric Railway, which is expected to be finished in two years; for the renovation of tramway lines and rolling stock; and for the provision of a large number of motor-'buses. Including the above sum, the total amount of British capital invested in this business will be about £3,500,000.

## Australian Bribery Charges.

The Canberra correspondent of *The Times* states that on May 22nd Mr. Justice Dethridge began his investigation as Royal Commissioner into allegations of bribery against members of the Federal Public Accounts Committee. The Committee has been examining the claims for compensation brought by the broadcasting companies against the Government on the taking over of the "A" class broadcasting stations, and it was alleged by Mr. Roland Green, a member of the Committee, that every other member had accepted a bribe from the claimants.

At the resumption of the inquiry on May 23rd, Mr. Justice Dethridge said he did not believe that Mr. Coleman, the chairman of the committee, had received £500, as alleged by Mr. Green. Major Conder, manager of the Dominion Broadcasting Co., denied that bribes had been offered to any member of the committee.

## Dundee and Foreign Cable.

At a meeting of Dundee Corporation Electricity Committee last week offers submitted for the supply of cable showed that the lowest foreign tender was 23 per cent. cheaper than the lowest British offer. The Convener said the foreign tenderers had made a greater allowance than the British for the fall in the price of copper. He did not think it was in the interests of the citizens of Dundee to pay £500 more in this case in order to support a "ring." It was decided to give the contract to the lowest foreign tenderer.

## An Electrical Trades Association.

We have received from Mr. David Pollock, Mitre Chambers, Mitre Street, E.C.3, some particulars of a new organisation which has been formed under the title "The Electrical Trades Association." This has as its objects the regulation of credit and the provision of credit information, debt collection, the representation of members at creditors' meetings, &c.

## Unemployment.

The Ministry of Labour returns show an increase of 27,504 in the number of persons on the registers of employment exchanges in Great Britain during the week ended May 12th. At that date the total was 1,739,500, as compared with 1,711,966 on May 5th, and 1,104,662 on May 13th, 1929.

## G.E.C. Fan Campaign.

The General Electric Co., Ltd. is again conducting a publicity campaign in connection with its electric fans. The company is advertising "Magnet" fans in many of the most prominent business journals, as well as in a large number of magazines. To supplement this it has devised handsome showcards, printed in colours, for the use of dealers, and the display of these, in windows and showrooms and on counters, will effectively link up with the advertising campaign. In addition, a tastefully-printed folder advocating the advantages of fans, and giving details and prices of the "Magnet" range of fans, is available for dealers' distribution. This folder is designed to be overprinted with a dealer's own name and address.

## E.D.A. Activities.

The June programme of the British Electrical Development Association is now published and it includes the usual monthly features, special attention being drawn to cookers, fans, irons and refrigerators. With the programme is issued a pamphlet containing details of the refrigeration campaign in which form letters are given for various classes of users. The accompanying illustrations show the Association's suggested window display for June and a special window display in connection with the refrigeration campaign, which is free to members.

**The E.D.A. June Window Display.**

**The Refrigeration Campaign Window Display.**

## Recent Contract.

The Alton Battery Co., Ltd., has received a contract to completely renew the positive plates in one of the largest batteries in London, and considers this to be one of its greatest successes. The battery is situated at the Metropolitan Electric Supply Company's sub-station, Fisher Street, W.C.

## Johnson & Phillips's Pensions Scheme.

Messrs. Johnson & Phillips, Ltd., have recently introduced pension and group life insurance schemes for the benefit of their staff and employés. In the case of all employés (staff and works) there is a minimum life assurance of £100 for which the works employés pay a weekly contribution of 3d., all additional costs being met by the company. The pensions scheme is applicable to the staff, including foremen and charge-hands, and is arranged on a graduated scale according to annual service. The weekly contribution represents 1s. for every £ of pension payable weekly after the age of 65. The amount of pension rises from £1 per week (with £100 life assurance) for a salary under £150, to £15 per week (with £800 life assurance) in the case of a salary over £1,500. Staff employés who are already over 65 will be provided with life assurance of £100 free of cost while they remain in the company's employment or are retired on pension. In addition to the pensions for future service towards which the company and the employés jointly contribute, pensions for past service are being provided by the company entirely at its own expense up to a maximum of £3 10s. in annual pension for each year of such past service. There are many optional features of the plan, among them being pensions which may be continued for a widow for life if the member is willing to accept a slightly smaller pension for himself. Optional retirement ages ranging from 55 to 70, with the approval of the company and with adjusted benefits, are also provided. In the event of death before going on pension all the member's contributions in addition to the life assurance to which he is entitled will be returned to his beneficiary. In the event of death after going on pension all contributions in excess of that already received in pension, in addition to the £100 of life assurance, will be returned. In the event of total and permanent disability before age 60 the life assurance would be paid direct to the member in from 40 to 60 monthly instalments. The schemes are administered by the Metropolitan Life Insurance Co., of New York.

## New Catalogues and Lists.

Messrs. Callender's Cable & Construction Co., Ltd., 2, Surrey Street, Strand, W.C.2.—A leaflet drawing attention to the company's "C.R." type pathway frames and covers. Illustrated and priced.

Messrs. Wolf & Morgan, Ltd., 66, Victoria Street, S.W.1.—A stock list of motors ranging from 1/20 to 3 h.p.

Santon, Ltd., Dock Street, Newport, Mon.—Two illustrated price lists of the Santon circulator, cooker, water heating, and wash boiler control boards, replacement fuses for control boards, &c.

Hamworthy Engineering Co., Ltd., Poole, Dorset.—An illustrated leaflet giving details, with dimensions, prices, and shipping particulars, of the Hamworthy junior air compressors.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Leaflet No. 1035, giving illustrated particulars of automatic star-delta starters.

Messrs. Rd. Johnson, Clapham & Morris, Ltd., Jacem House, Trafford Park, Manchester.—A circular distributed to the retail trade in connection with the company's "Nu-Vac" suction cleaner campaign.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—A folder drawing attention to "Henley" adhesive tape. Priced.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, W.C.2.—Illustrated pamphlets Nos. 478 and 479 dealing, respectively, with electric fans and the "Busy Bee" refrigerator.

Brook Motors, Ltd., Empress Works, Huddersfield.—A leaflet giving a few specimen prices of Brook motors. Also a pamphlet containing a "Who's Who" of the personnel of the company.

Brookhirst Switchgear, Ltd.—Leaflets Nos. 290 and 303, giving brief details of d.c. automatic motor gear, midget contactor type starter, M.C. 40, and a.c. automatic motor control gear contactor type straight-on starting panel, SCA.30.

Drayton Regulator & Instrument Co., Ltd., West Drayton, Middlesex.—An illustrated leaflet giving brief particulars and prices of the "Drayton" room type temperature recorder and recording "Psychrometer."

Domestic Electrification, Ltd., Townsend Place, Greycoat Place, Westminster, S.W.1.—A pamphlet drawing attention to the "Dolphin" automatic safety iron with the "Klixon" patent thermostat.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Two publications (Book 2, section 1b, and Book 5, section 1e) containing respectively illustrated particulars and prices of telephones for offices, institutes and industry, and the "Pulsyn-etic" system of electric impulse clocks and time discipline apparatus.

Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2.—A well-produced brochure dealing with the company's power speaker equipments, and containing some excellent illustrations of installations carried out by the company, showing some of the many applications of these equipments.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—A booklet containing a full description of the company's electric water heaters, together with notes on the application of this equip-

ment to the home, and directions for its installation. Also a leaflet containing brief particulars of water heaters together with prices and overall dimensions.

MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Charing Cross Road, W.C.2.—A number of publications and "dealer aids" issued in connection with a publicity campaign about to be undertaken by the company in connection with its rectifier valves. Included with these publications is a booklet giving full technical data, output curves and prices of an extended and comprehensive range of rectifiers, and an article on high-tension supply.

## Australian Business Changes Hands.

Mr. A. S. Langsford, managing director of Messrs. Langsford, Cooper, Ltd., Adelaide, South Australia, has sold his electrical supply business to Messrs. Unbehaun & Johnstone, Ltd. At a luncheon given by the South Australian Electrical Importers' and Suppliers' Association recently, Mr. Langsford was presented with a smoker's outfit in recognition of the services which he has rendered to the Association.

## The South African E.D.A.

The Cape Town Municipal Electricity Committee has recommended that the Council shall subscribe a minimum of £100 per annum to the newly-formed Electrical Development Association of Southern Africa, with a maximum of £250, until a branch is established in the Cape Peninsula. There is a proviso that other municipalities shall support the movement.

## Electricity Aids a Gas Association.

Speaking at last week's annual meeting of the Imperial Continental Gas Association, the chairman (Col. H. Le Roy Lewis) said that the revival of the Association's fortunes was largely due to the great development which had taken place in the sale of electricity, for whereas in 1913 their output amounted only to 2,000,000 kWh, during the year under review the companies in which they were interested sold 148,000,000 kWh. On the other hand, their output of gas, which during last year amounted to 282,000,000 cubic metres, showed a drop from the output of 1913, when it stood at 465,000,000 cubic metres. It should not be deduced from this that gas had failed to make headway; the reverse was the case, as the 1929 consumption of the towns which they still supplied showed an increase of 41 per cent. upon the consumption of those towns in 1913. The drop in question was entirely due to the loss of their German undertakings.

## For Sale.

Liverpool Corporation Electric Supply Department has for sale generating sets and an evaporative condenser.

The Northampton Polytechnic Institute has generating station equipment for sale.

(See our advertisement pages to-day.)

## The Portuguese Market: An Inquiry.

Messrs. MCDONALD, SCALES & CO., 4, Chapel Street, Whitecross Street, E.C.2, inform us that they are contemplating appointing a representative in Portugal and would like to hear from manufacturers of electrical goods suitable for that market.

## The National Radio Exhibition.

We have received from the Radio Manufacturers' Association some particulars of the National Radio Exhibition which is to be held in the New Hall, Olympia, from Sept. 19th to 27th next. The matter includes plans of the ground floor and gallery showing the positions of stands, their floor areas, and the charges therefor, the Board of Trade requirements with regard to the provisional protection of inventions, and a form of contract. It is stated that all firms whose applications for space are received by June 14th will be included in the ballots for positions. The arrangements are in the hands of the Association's Exhibitions Organiser, Mr. A. E. Moody, Astor House, Aldwych, W.C.2.

## American Vacuum Cleaners.

At a recent meeting of the Kirkham Council a councillor said that enclosed with his electricity account received that day from the Preston Corporation was a card advertising the claims of an American vacuum cleaner for which the Department was an agent. That he regarded as an insult to the Kirkham Council, which recently pledged itself to buy British goods wherever possible, as well as an insult to the British working men, more than a million and a half of whom were on the "dole." It was decided to send a letter to the Preston Corporation expressing regret at the action of the Electricity Department, stating that the Corporation should take steps to advertise a British vacuum cleaner.

## Chinese Electricity Supply Regulations.

A set of regulations governing private electrical enterprises in China was adopted at a recent meeting of the Legislative Yuan. The new regulations, which are to be submitted immediately to the State Council for approval and promulgation, contain the following points:—(1) Without special authorisation from the responsible government department (*i.e.*, the National Reconstruction Commission), no private electrical undertaking shall be permitted. (2) For the purpose of expansion, a private electrical company may, with the permission of the National Reconstruction Commission and the Ministry of Industry, Commerce, and Labour, issue bonds not to exceed half of the total assets of the company. (3) By special permission of the responsible authorities, a private electrical company may, whenever necessary, make use of rivers, creeks, tunnels, bridges or roads, provided that such use does not interfere with the utility of the said public property. (4) A private electrical company may, with permission of the landowner or other interested parties, lay electrical wires on such land or over the buildings on the land. (5) A private electrical company may, with permission of the landowner or other interested parties, remove such trees or plants on the land as are obstructive to the wires.

## Submersible Motors.

We understand that Mr. T. L. Reed-Cooper, M.I.Mech.E., of Abbey House, Westminster, has purchased the goodwill, drawings, patterns, &c., of Submersible Motors, Ltd., with a view to combining that company's with his own business in "Electromersible" pumps. He is therefore in a position to supply any repeat orders, rewinds, or spare parts which may be required.

## Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

| | CHEMICALS, &c. | Price May 27th. | Fortnight's inc. or dec. |
|---|---|---|---|
| a | Acid, Oxalic ... ... ... ... per lb. | 5¾d. | ... |
| a | Ammoniac, Sal ... ... ... per ton | £60 | ... |
| a | Ammonia, Muriate (large crystal) ,, | £52 | ... |
| a | Bisulphide of Carbon ... ... ,, | ... | ... |
| a | Borax ... ... ... ... ... ,, | £25 | ... |
| a | Copper Sulphate ... ... ... ,, | £25 10s. | ... |
| a | Potash, Chlorate ... ... .. per lb. | 3d. to 4d. | ... |
| a | ,, Perchlorate ... ... ... ,, | 5½d. | ... |
| a | Shellac ... ... ... ... per cwt. | £13 10s. | ... |
| a | Sulphur, Commercial ... ... ,, | £11 | ... |
| a | ,, Roll ... ... ... ,, | £11 | ... |
| a | Soda, Chlorate ... ... ... per lb. | 3d. | ... |
| a | ,, Crystals ... ... ... per ton. | £5 to £5 5s. | ... |
| a | Sodium Bichromate, casks ... per lb. | 3¾d. | ... |
| | **METALS, &c.** | | |
| b | Aluminium, Ingots ... ... per ton. | £95 to £100 | ... |
| b | ,, Wire ... ... ... per lb. | 1/1 to 1/9 | ... |
| b | ,, Sheet ... ... ... ,, | 1/1 to 2/9 | ... |
| p | Babbitts Metal and Anti-friction Metals— | | |
| | Grade I ... ... ... per ton net. | £186 | £2 dec. |
| | Grade II ... ... ... ,, ,, | £97 | £1 dec. |
| | Grade III ... ... ... ,, ,, | £57 | ... |
| c | Brass (rolled metal 2' to 12' basis) per lb. | 8½d. | ... |
| c | ,, Tubes (solid drawn) ... ,, | 11d. to 11½d. | ... |
| c | ,, Wire, basis ... ... ... ,, | 9¾d. | ... |
| c | Copper Tubes (solid drawn) ... ,, | 1/0½ | ... |
| g | ,, Bars (best selected) ... per ton | £87 | ... |
| g | ,, Sheet ... ... ... ,, | £87 | ... |
| g | ,, Rod ... ... ... ... ,, | £87 | ... |
| d | ,, (Electrolytic) Bars ... ,, | £61 10s. | £4 10s. dec. |
| d | ,, ,, Sheets ... ,, | £148 10s. | ... |
| d | ,, ,, Wire Rods ,, | £70 | £6 dec. |
| d | ,, ,, H.C. Wire per lb. | 9½ | ½d. dec. |
| f | Ebonite Rod ... ... ... ,, | 2/3 to 2/6 | ... |
| f | ,, Sheet ... ... ... ,, | 2/3 to 2/6 | ... |
| n | German Silver Wire ... ... ,, | 2/1 | ... |
| h | Gutta-percha, fine ... ... ... ,, | nom. | ... |
| h | India-rubber, Para fine ... ... ,, | 7¾d. | ¼d. dec. |
| i | Iron, Pig (Cleveland No. 3.) ... per ton. | 70/6 | 12s. inc. |
| l | ,, Wire, galv. No. 8. P.O. qual. ,, | £20 | ... |
| g | Lead, English pig ... ... ... ,, | £19 10s. | 10s. dec. |
| g | Mercury ... ... ... ... per bot. | £22 12s. 6s. to £22 15s. | ... |
| e | Mica (in original cases) small ... per lb. | 6d. to 3/- | ... |
| e | ,, ,, medium ,, | 4/- to 8/- | ... |
| e | ,, ,, large ... ,, | 10/- to 20/- & up | ... |
| p | Phosphor Bronze, plain castings ,, | 1/2½d. | 1d. dec. |
| p | ,, ,, drawn bars & rods ,, | 1/8 | ... |
| p | ,, ,, rolled strip & sheet ,, | 1/3½ | ¼d. inc. |
| p | ,, ,, wire ... ... ... ,, | 1/3½ | ¼d. dec. |
| o | Platinum ... ... ... ... per oz. | £8 15s. | ... |
| d | Silicium Bronze Wire ... ... per lb. | 10½d. | 3½d. dec. |
| r | Steel, Magnet, in bars ... ... ,, | 7½d. | ... |
| g | Tin, Block (English) ... ... per ton | £144 5s. to £144 15s. | £7 dec. |
| n | ,, Wire, Nos. 1 to 16 ... ... per lb. | 3/2 | ... |

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co., in their letter dated May 24th, state that the lead market had a steadier tone last week, opening a little easier but subsequently firming up. Demand remains quiet both in this country and on the Continent, but as producers sold fairly well on the recent rise, they may be able to keep prices steady at the present level for a time. Heavy arrivals, however, are expected next month, and it remains to be seen whether these can be absorbed without affecting prices. There is nothing in the present position to justify a higher level except for the fact that supplies are closely controlled.

# Lighting and Power Notes.

**Abergavenny.**—Electricity Scheme.—At a recent meeting of the Town Council it was decided to proceed with an electricity scheme for the borough. The supply, which is to be taken from the Shropshire, Worcestershire & Staffordshire Electric Power Co. is expected to be available by the end of the year.

**Australia.**—Hydro-electric Scheme for Kempsey.—The engineers of the Clarence River County Council hydro-electric undertaking have now completed a survey of the Macleay River with the object of ascertaining whether an electricity scheme can be economically introduced to serve the district. Their report states that such a scheme is possible provided an up-to-date plant is installed at Kempsey to augment the supply until electrical energy is available from the north.

**Aylesbury.**—Extension Schemes.—The Town Council has applied for sanction to a loan of £1,542 for excess expenditure incurred in connection with the electricity scheme for Bradenham. The electrical engineer is to submit a further report with regard to a scheme for the supply of electricity to Cholesbury, Longwick, and Wotton, based on the lines tentatively arranged with the Electricity Commissioners.

**Bedford.**—Mains Extensions.—The Corporation Electricity Committee is to apply for sanction to a loan of £20,000 for mains.

**Bexhill.**—Sub-station Equipment.—The Corporation Electricity Committee has received sanction to the borrowing of £3,959 for the provision of sub-station equipment.

**Bognor Regis.**—Extensions.—The Bognor Regis Gas and Electricity Co. is now extending its electricity supply system to New City and Elmer Beach. The scheme includes the erection of a sub-station at the New City and an extension of the 11,000-V main and distribution system.

**Bury St. Edmunds.**—New Business Lighting Tariff.—The Town Council has decided to offer a tariff for all business premises of £13 per annum for the first kW of total lighting installed, and £12 per annum for each additional kW of total lighting installed, plus 1½d. per kWh consumed.

**Canada.**—Large Plant Contract.—The Beauharnois Power Corporation has awarded to the Canadian General Electric Company, of Toronto, the contract for two 25-cycle, 50,000-h.p., generators, two 60-cycle, 50,000-h.p. units and an additional two 8,000-h.p. units. The generators are to be delivered by the spring of 1932. The water wheels to operate the generators have already been purchased from the Dominion Engineering Works. It is proposed eventually to bring the capacity of the plant installed up to 500,000 h.p.

Hydro-electric Development.—The Shawinigan Water and Power Co., Ltd., is seeking the approval of the Minister of Lands and Forests of Quebec to the plans of the proposed Rapide Blanc station, the first of six new developments along the Upper St. Maurice River contemplated by the company for execution during the next few years. The plans for the Rapide Blanc site contemplate the installation of 160,000 h.p. at a cost of $13,000,000. The Falls to be harnessed by the first of the series of generating stations are situated some 25 miles north of La Tuque.

The West Kootenay Power and Light Company, which has recently been granted authority to develop hydro-electric power on the Pend d'Oreille River in southern British Columbia, near Trail, is amending its application to the Provincial Water Board. The company now asks for the right to build two dams across the river instead of the single large dam originally contemplated.

**Carlisle**—Loans.—The Corporation Electricity Committee recommends that application be made for sanction to the following loans:—£5,000 for assisted wiring installations; £15,000 for mains and services; and £5,000 for transformers and sub-stations.

**Chesterfield.**—Year's Working.—We have received from Mr. D. H. Davies, the borough electrical engineer, a copy of his progress report for the year ended March 31st last. The electrical energy sold for all purposes amounted to 12,561,637 kWh, which is an increase of over 9 per cent. as compared with the previous year. The maximum load demanded increased by 2½ per cent. to 6,003 kW. The total number of consumers connected now totals 11,110, an increase of 17 per cent.; 1,164 new installations were connected under the hired wiring scheme, bringing the total number of hired wiring consumers connected to 5,113. The scheme for the hiring out of domestic apparatus has met with considerable success, and there are now 429 cookers, 280 electric fires, 15 grills, 38 wash-boilers, and 351 kettles out on hire. The result of the year's working was a net profit of £2,516, as compared with £9,515 for the previous year. This decrease is more than accounted for by an increase in rates amounting to £5,712 under the new assessment and by the decrease in charges of 6 per cent. per kWh to lighting consumers which came into operation on October 1st, 1929, and meant a concession of £1,570. With regard to this policy of reducing charges, the engineer states that the Electricity Committee does not see any advantage in making comparatively large annual profits in view of the fact that the reserve fund at approximately £38,000 is well above the statutory requirements.

**Croydon.**—Apparatus for Hire.—The Corporation Electricity Committee recommends the purchase of apparatus for hire up to the amount of £15,000.

**Glasgow.**—Proposed Tariff Reductions.—A scheme for reducing the electricity tariffs and fixing new bases of charging is recommended by the Corporation Electricity Committee. It is proposed to revise the two-rate residential tariff (present primary rate, 6d. per kWh; secondary rate, ¾d. per kWh) so that the primary rate will be 4½d. per kWh and the secondary rate ¾d. per kWh. The basis is, however, to be changed so that the primary rate will be on 30 kWh per apartment per annum, with a minimum of 60 kWh. Should the primary rate consumption in any survey period not be reached, the number of kWh unaccounted for will be carried forward to the following survey period or periods, and charged for before the secondary rate becomes operative. Under the proposals the domestic service tariff will consist of: (*a*) A fixed charge of 30s. per annum, with an addition of 15s. for each apartment in excess of two; and (*b*) a "unit" charge of ½d. Reductions in charges are also recommended in the non-residential scales.

**Great Yarmouth.**—Public Lighting.—The Corporation Public Lighting Committee recommends a scheme for the improved lighting of the borough by electricity at a cost of £18,285.

**Isle of Man.**—Reading of Electricity Bill Postponed.—The third reading of the Manx Electricity Bill promoted by the Electrical Development and Securities Trust, Ltd., has been postponed by the Manx House of Keys until October. The Bill was passed by the Legislative Council, but in the House of Keys dissatisfaction was expressed regarding the financial aspect of the scheme. Objections were also raised by the Electricity Commissioners. A conference is to take place between the Governor of the Island, the Electricity Commissioners and the promoters of the Bill.

**Kettering.**—Electricity Supply to Rushton.—The Urban District Council Lighting Committee is to give a supply of electricity to Rushton by means of overhead lines, provided a guarantee of approximately £225 per annum is obtained.

**Lichfield.**—Overhead Lines.—The City Council has decided to extend the supply to Alrewas by an 11,000-V overhead transmission line at an estimated cost of £5,448, for which a loan and an unemployment grant are to be applied for.

**London.**—Stoke Newington.—The Borough Council Electricity Committee recommends that application be made for sanction to a loan of £24,310 (less any amounts the borrowing of which has already been sanctioned), in connection with the carrying out of the southern section of the extension of the undertaking. Sanction has been obtained to a loan of £5,000 for meters. The Committee also recommends the extension of mains at an estimated cost of £3,336.

Battersea.—The Borough Council Electricity Committee has obtained sanction to loans of £6,987 for mains, and £13,320 for plant, switchgear, &c. The Committee has authorised the following works:—Electricity services to 85 premises, £816; extension of mains for private services, £975; and extensions of mains for public lighting, and conversion of gas lamps, £271.

Overhead Lines Across the Thames.—According to *The Times*, two steel towers, which will each be 500 ft. high, are to be erected by the Central Electricity Board on the north and south banks of the Thames. One will probably be between Barking and Dagenham, and the other east of Woolwich. The towers are to be used for overhead lines which will eventually connect the land lines from Peterborough and northern sections of the Home Counties electricity grid, and later the southern areas. Land lines are being laid between Deptford and Eltham, which will carry energy at 132,000 V.

Poplar.—The Borough Council Electricity Committee is to extend mains at a cost of £3,914, in connection with the h.p. supply to the Blackwall Tunnel, &c.

**Lowestoft.**—Change-over.—The Town Council is to apply for sanction to a loan of £5,500 to cover the cost of changing-over from d.c. to a.c. at Oulton Broad.

**Northern Ireland.**—Electricity Supply Scheme.—The Government of Northern Ireland has approved the electricity scheme prepared by Mr. J. M. Kennedy, consulting engineer, details of which appeared in the Electrical Review of May 16th. Parliamentary powers are now being sought to carry out the work.

Lurgan (Co. Armagh).—The Urban District Council is to enter into negotiations with the Belfast Corporation for a bulk supply of electricity for Lurgan. In order to take this supply an extension of the existing overhead line would have to be made from Lisburn through Hillsborough, Dromore, Donacloney, and Waringstown, the cost being approximately £850 per mile over a distance of 16 miles. This would be the first link in the new system suggested by Mr. J. M. Kennedy, consulting engineer to the Electricity Commissioners, in his report on the counties of Antrim and Down.

**North Wales.**—Extensions.—The North Wales Power Co., Ltd., has made application for financial assistance under the Development Act, 1929, to enable the company to extend the

Maentwrog power station, and to accelerate the extension of its transmission system, which includes the erection of lines from Bangor to Holyhead, Pwllheli to Abersoch, Oswestry to Crewe, Welshpool to Montgomery and Newtown, and Maentwrog to Barmouth.

**Plymouth.**—MAINS EXTENSIONS.—The Corporation Electricity Committee has sanctioned mains extensions in 18 streets in Plymouth and Devonport, at a total cost of approximately £1,200.

**Special Orders.**—The Sheffield Corporation has applied to the Electricity Commissioners for a Special Order authorising it to extend its area of supply to include the urban district of Dronfield and the parish of Beighton, in the urban district of Chesterfield.

The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Old Silkstone Collieries, Ltd., to supply electricity in the urban districts of Arlecdon and Frizinton, Aspatria, Cockermouth, Harrington, Holme Cultram, Maryport, and Wigton, the rural districts of Alston-with-Garrigill, Cockermouth, Penrith, and Wigton and part of the rural district of Whitehaven.

**Stirling.**—NEW SUB-STATION.—A new sub-station is to be erected at Borestone Crescent, St. Ninians, Stirling, at a cost of £7,064.

**Tottington.**—STREET LIGHTING.—The Urban District Council has decided that, in the event of the Lancashire Electric Power Co. extending its supply to Four Lane Ends, it will adopt electricity for road lighting within two years.

**United States.**—HYDRO-ELECTRIC DEVELOPMENT.—According to *Power* the Dallas Power and Light Company has asked the City Commission of Dallas, Texas, to approve a plan providing for an additional expenditure of $8,587,000 during the next four years for the further expansion of Mountain Creek. The company plans not only to build a $5,500,000 plant capable of generating 35,000 kW, but also to construct at a cost of $1,500,000 a reservoir in Mountain Creek, covering a possible 6,000-acre tract. The lake would be used not only by the new plant but would also serve the existing 82,000-kW plant in North Dallas. The company contemplates that another $1,500,000 would be required to pay for transmission lines and other equipment.

NEW MUSCLE SHOALS BILL APPROVED BY HOUSE COMMITTEE.—After deliberating for three weeks the House Committee on Military Affairs has approved the new Muscle Shoals Bill prepared by its drafting sub-committee. Early passage by the House is foreseen. Then the Bill goes directly to conference before it is submitted to the Senate again. The Bill empowers the President to appoint without confirmation a board of three eminent citizens, one of whom will be identified with agriculture. The Board is to appraise the property and then to lease it on the best terms possible for fertiliser, ferro-alloy, and other electro-chemical production. Excess power is to be allocated within economic range.

# Tramway and Railway Notes.

**Colwyn Bay.**—TRAMWAY RECONSTRUCTION.—A commencement has been made with the construction of a double tramway track along a part of Conway Road.

**Continental.**—SPAIN.—Of the 10,200 miles of railway in Spain, 600 miles have now been electrified and work is in progress involving the conversion of another 1,200 miles.

**Dearne Valley.**—EXTENSION OF TIME.—The Dearne District Light Railways Joint Committee is to apply to the Ministry of Transport for an extension of the time limited for the completion of the works authorised by the Dearne District Light Railways Orders to June 24th, 1931.

**Leyton.**—NEW TRAMCARS.—In connection with the through-running arrangements with the London County Council, the Corporation Tramways Committee has arranged for the purchase of fifty tramcars.

**Liverpool.**—EXTENSION OF TIME.—The Corporation has given notice of its intention to apply to the Ministry of Transport to prolong until July 31st, 1931, the time limited for the commencement or completion of various tramways authorised by the Liverpool Corporation Tramways Order, 1925.

**London.**—NEW TUBE TRAINS.—Orders for 62 new carriages have been placed provisionally by the London Electric Railway Co. with the Metropolitan-Cammell Carriage, Wagon and Finance Co., Ltd. The electrical equipment is to be supplied by the British Thomson-Houston Co., Ltd., and the motors by the General Electric Co., Ltd. The new cars are to be used on the service between the Elephant and Castle (Underground) and Watford (L.M.S.) stations.

# Telegraph and Telephone Notes.

**India.**—RADIO-TELEPHONY.—It is understood that negotiations are proceeding between the Indian Radio Co. and the Indian Government with a view to establishing a wireless telephony service between India and the United Kingdom, to be conducted by the British Post Office through Rugby. The reciprocal arrangements, including the installation of a special transmitter, in India are not likely to occupy more than three months.

**Irish Free State.**—TELEPHONY.—During the debate on the financial estimates in the Dail, Mr. M. Heffernan, Parliamentary Secretary for Posts and Telegraphs, stated that the loss on the telephone service had decreased, although overhead charges had greatly increased. Despite statements to the contrary, the scale of charges was comparatively moderate, and consequently the task of balancing the account would be very difficult in future. They had increased the number of local exchanges during the year, and there was an increase of 51 in the number of call offices, bringing the total to 1,211. The automatic telephone system had been extended in Dublin, but in rural towns the demand for the service had shown little sign of expansion.

TELEGRAPHY.—The traffic continued to decline. The estimated number of telegrams, excluding Press messages, originating in the Free State last year was 2,069,000, compared with 2,411,000 during the previous year. The expenses of the service had been curtailed considerably. The Department, after a full investigation, was satisfied that the increased minimum charge imposed in August, 1928, had resulted in a saving in the cost of the service. The volume of traffic compared favourably with that in many other countries.

**Italy.**—RADIO BEACON.—Next month the first radio beacon in the country is to be inaugurated at Venice, in order to facilitate navigation, especially entry into harbour during fog. The lightship will emit an electro-magnetic field on varying waves from 500 to 1,100 metres which will be easily accessible to airplanes. After a period of tests it will be possible to judge the advisability, or otherwise, of installing another wireless lightship at the airport of Taliedo (Rome).

**Japan.**—RADIO-TELEGRAPHY.—The Japan Wireless Co. has installed short-wave transmitting plant of the R.C.A. type in the station in Aichi Prefecture, which carries on wireless traffic with Europe exclusively, while the receiving station at Yokkaichi, in Miye Prefecture, has been equipped with beam appliances of the Marconi type. Direct Anglo-Japanese communication was realised on January 26th.

**Mongolia.**—RADIO-COMMUNICATION.—The construction of ten radio transmitting stations at various important centres in inner and outer Mongolia and Tibet is being planned for by the Ministry of Communications. They will be operated by the Government and, besides the transmission of official dispatches, will also be open for public communication.

**Police Radio-communication.**—BRITAIN.—At a recent conference of County Chief Constables at the Home Office it was proposed to establish three main wireless stations for the quick interchange of information regarding crimes and the movements of criminals, and the distribution of such information to sub-stations and divisional offices. The main stations would be in London (Scotland Yard), the Midlands (probably Birmingham), and the north (Glasgow or Edinburgh). A more detailed scheme, which would have cost £3,000,000, was rejected on the score of expense.

CANADA.—*Reuter's* Toronto correspondent states that this month the Ontario Provincial Police inaugurated a wireless network linking up district police stations all over Ontario with the departmental headquarters in the city. The code to be used will be a secret one and the wavelength will be known only to provincial police officials; each district will have its own radio operator.

FRANCE.—The Eiffel Tower, Paris, short-wave station is now to be used as the centre of an extensive police radio service. Receiving stations will be established all over France and at boundary towns and seaports.

**Switzerland.**—LEAGUE OF NATIONS.—An agreement for the establishment of a specal wireless station for the League of Nations in times of emergency has been signed on behalf of the League and of the Swiss Government. The station is to have a world-wide radius. In normal times it is to be run by the Radio Suisse Company. When it is run by the League the Swiss Government will be entitled to have an observer present.

**The Telephone Service.**—A LARGE P.B.X.—Three thousand telephones, a record number for any single European building, will be installed in Thames House, Westminster, London, on its completion in 1931. The previous record in this country was held by Imperial Chemical House, which had 2,000. In view of the size of the building, which contains three miles of corridors, is of eleven stories, and has 770,000 sq. ft. of floor space, it is proposed to equip Thames House with public call boxes and a system of private inter-communication telephones.

**United States.**—AUTOMATIC TELEPHONES.—All dial telephones have been ordered to be removed from the Senate wing of the Capitol by a special resolution of the Senate, members of which have complained that automatic 'phones are a "nuisance."—*Reuter* (Washington).

# Radio Notes.

**China.**—New Station.—A contract was recently signed by the Nanking Government for the erection in Nanking of a powerful broadcasting station. The Telefunken Co., of Berlin, represented by the Siemens China Co., has secured the order, and the plant will be erected near the Yangtsze River, with two 400-ft. self-supporting steel masts. Power plant of 600 h.p. will render the station independent of power supply from the city electricity works. A special cable will connect the station with the studio in the centre of the capital of the Republic.

**Finland.**—Licences.—The number of licensed listeners now totals 90,232, of whom some 12,984 are of Swedish nationality.

**Hungary.**—New Station.—With respect to the re-organisation of the country's broadcasting system, the Postmaster-General has granted the necessary licence for the erection of a new transmitting station near Budapest of 120 kW, against the present station's 20-kW power. Should it not serve the whole country adequately relay stations may be established, and it is intended to use short waves in addition to the normal band mainly to serve farmers.

**I.E.E. Wiring Regulations.**—Revision.—A revised supplement to the ninth edition of the I.E.E. Regulations for the Electrical Equipment of Buildings has been issued. It relates to radio-receiving and valve-amplifying apparatus connected to electricity supply mains, and is in substitution for the corresponding supplement issued in June, 1928, which has now been withdrawn. Copies can be obtained, free of charge, on application to the secretary of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

**Irish Free State.**—During the debate on the financial estimates in the Dail, Mr. M. Heffernan, Parliamentary Secretary for Posts and Telegraphs, relative to a motion for a sum not to exceed £66,386 for the completion of the amount required to defray the estimated charges for wireless broadcasting, said it was estimated that there would be an increase in the cost of the service of £48,876 over 1929 in the coming year, of which £47,700 would be for the proposed central high-power station. Receipts from licence fees during the past year amounted to £13,355, and from the import tax on apparatus £30,700. The net revenue was £39,966 and the expenditure £28,259, leaving an estimated gross surplus of £11,427. Of that, about £3,000 must be set-off for interest and depreciation. The number of licences issued during the year was 25,269, a decrease of 75. The falling-off was temporary. The extent to which the evasion of payment for licences went on was problematical, and the necessity for further legislation was under consideration. The revenue of £30,700 from the Customs tax on apparatus showed an increase of about £3,000. In the coming year the revenue estimated was £14,000 from licence dues and £30,000 from Customs tax, leaving a net revenue of £39,600. The total expenditure on the Dublin and Cork stations was estimated at £32,000. Of the total population of 3,000,000, only about 700,000, or 23 per cent., were estimated to reside within the range of crystal reception of the Dublin and Cork stations. The wavelength of the Dublin station was suitable for a high-power station, and it would be utilised for the new station. Its total cost would be between £57,500 and £62,500, of which £50,700 was to be provided for in the current financial year. An additional annual revenue of £20,000 would be required to meet interest, depreciation, and maintenance charges, and an increased revenue of £24,000 was estimated, which would leave some thousands over for programme development. There was every likelihood that the service would pay its way.

**Regulations.**—Conference.—The Fourth International Conference on Wireless Regulations is to be held at Liége from September 22nd to 26th next. The meetings will be officially opened by Mr. Forthomme, Belgian Minister of Posts and Telegraphs.

# Contract Information.

**When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.**

## Contracts Open.

**Australia.**—Melbourne.—July 30th. Victorian Railway Commissioners. Turbo-alternators, condensing plant, and control gear. (B.X. 6355.)*

Renewals for caustic soda primary cells. (B.X. 6441.)*

July 8th. Posts and Telegraphs Department. Telephonists' telephones. (B.X. 6352.)* Telephone generators. (B.X. 6376.)*

July 9th. City Council. Supply of totally-enclosed metal-clad switchgear. (B.X. 6401.)*

**Belgium.**—June 5th. Municipal Authorities of Schaerbeek. 6,500 metres of l.p. armoured cable and 4,000 metres of h.p. ditto. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

**Canada.**—Toronto.—June 10th. Hydro-electric Power Commission. Transformers for the Chats Falls transformer station. (B.X. 6436.)*

**Dundee.**—June 12th. Electricity Department. Supply and laying of approximately 655 ft. 42-in. diameter cast-iron spigot and faucet piping. (May 9th.)

**East Ham.**—June 18th. Education Committee. Installation of electric lighting at the Monega and Sandringham schools. (May 23rd.)

**Egypt.**—Cairo.—August 17th. Mechanical Department, Ministry of Public Works. Supply and erection of fifteen electric pumping stations, with pumps, motors, switchgear, &c. Specifications, &c. (deposit £10 5s.) from the chief inspecting engineer, Egyptian Government, 41, Tothill Street, S.W.1. Tenders to the Director-General, Mechanical and Electrical Department, Ministry of Public Works, Cairo.

July 26th. Ministry of the Interior. Supply and erection of a cooling tower for the electric power station at Assiout. (A.X. 9627.)*

**Glasgow.**—June 9th. Electricity Department. Supply of l.p. paper insulated, one, two, three, and four core, and e.h.p. cables, small india-rubber cables and flexibles, electric cookers, meters and electric kettles during the year ending May 31st, 1931. (May 23rd.)

**Hull.**—June 3rd. Electricity Department. Supply of stores for 12 months from July 1st, 1930. (See this issue.)

**India.**—June 23rd. India Store Department. Supply, delivery, and erection of 11,000- and 400-V a.c. and 220-V d.c. switchgear, power and control cables, &c., for Shanan power station. (May 16th.)

June 9th. Oil engine alternator set with switch and protective gear and cables. (B.X. 6445.)*

**Leeds.**—June 16th. Tramways Committee. 100 tramcar bodies; 100 tramcar trucks, including wheels and axles; 100 tramcar pneumatic brake equipments; 100 tramcar electrical equipments. Specification &c., on receipt of deposit (£2) from R. L. Horsfield, general manager and engineer.

**Leyton.**—June 13th. Corporation. Installation of water heating apparatus at Newport Road school and re-wiring electric light installation, Farmer Road school. (See this issue.)

**Liverpool.**—June 6th. Corporation. Installation of an automatic telephone exchange. (May 16th.)

June 2nd. Corporation Electricity Department. Supply of 41 motor-generator sets suitable for operation on a 400-V, 3-phase, 50-cycle supply, to give a d.c. output of 80 A at 70 V. (May 23rd.)

**London.**—Central Electricity Board.—June 11th. Supply, delivery, and erection of 33-kV transformers for the South-East England Electricity Scheme, 1927. (May 16th.)

Construction of site works, foundation works and buildings in the area of the North-West England and North Wales Electricity Scheme, 1928. (May 23rd.)

June 19th. Supply, delivery, and laying of 33-kV and other cables for the Central England Electricity Scheme, 1928. (May 23rd.)

June 23rd. Supply, delivery, and erection of 66,000-V and other cables for the Mid-East England Electricity Scheme, 1929. (May 23rd.)

June 30th. Metering equipment in the area of the Central England Electricity Scheme, 1928. (See this issue.)

H.M. Office of Works.—June 9th. Electrical accessories. (See this issue.)

June 10th. Fuseboards and switches. (See this issue.)

**New Zealand.**—Wellington.—June 24th. Public Works Department. Outdoor steelwork and 110-kV switchgear for the Waitaki power scheme. (B.X. 6238.)*

July 1st. 110-kV suspension insulators for the Waitaki Power Scheme. (B.X. 6443.)*

July 29th. Auxiliary turbines and generating sets. (B.X. 6356.)*

August 19th. Supply and delivery of three single-phase transformers for the Penrose sub-station. (B.X. 6427.)

June 25th. Posts and Telegraph Department. 100,000 3½-in. lead clips, 30,000 2-in. ditto, &c. (B.X. 6375.)*

July 16th. Government Railways. Four 30-cwt. overhead electric cranes for new goods sheds. (A.X. 9442.)*

AUCKLAND.—June 10th. Harbour Board. Submarine cable. (B.X. 6354.)*

**Northern Ireland.**—BELFAST.—June 4th. Belfast City and District Water Commissioners. Supply, delivery, and erection at the Oldpark works of electrically-operated pumping plant. Specifications, &c., from Mr. W. I. Quinn, secretary, Water Office, Belfast (returnable deposit of £1).

**Nottingham.**—June 17th. Electricity Department. Supply of general stores for 12 months commencing July 1st, 1930. (May 23rd.)

**Oswestry.**—June 14th. Electricity Department. Cables, switchgear and transformers. (See this issue.)

**Sleaford.**—June 11th. Electricity Department. Armoured, lead-covered cable. (See this issue.)

**South Africa.**—CAPETOWN.—June 25th. Electricity Department. Supply of single-phase transformers. (B.X. 6378.)*

JOHANNESBURG.—June 12th. S.A. Railways and Harbours. 2,000-V switch units and l.p. switchboards. (B.X. 6365.)*

June 19th. Supply and delivery of metal-clad 2,000-V switchboard for sub-station at Bloemfontein workshops. (B.X. 6402.)

July 28th. Twenty-eight electric lifts for the new railway building, Johannesburg. (A.X. 9623.)*

**Stockton-on-Tees.**—June 2nd. Electricity Department. Supply of paper-insulated cables. (May 23rd.)

**Warwickshire.**—The County Council is inviting tenders for the installation of electric light and power in the new County Offices at Warwick.

**Wolverhampton.**—June 17th. West Midlands Joint Electricity Authority. Double circuit 33,000-V overhead transmission line supported by steel towers. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

# Contracts Closed.

**Barnes.**—Urban Council. Accepted:—
One mile of cable (£570).—Siemens Bros. & Co., Ltd.

**Bedford.**—Town Council. Accepted:—
Construction of overhead lines comprised in the rural electrification scheme, including transforming points and switchgear (£23,772).—R. M. Russell.

**Belgium.**—Keen international competition was again experienced on May 14th when the Belgian Post and Telegraph Authorities in Brussels opened tenders for the supply of seven lots totalling 620 kilometres of lead-covered paper-insulated cable, tenders being received from Belgian, German, French, Dutch, Austrian, and British (Callender's Cable & Construction Co., Ltd.) firms. In all cases, however, the lowest offers emanated from Belgian cable manufacturers.

**Bexhill.**—Electricity Committee. Recommended:—
Rectifying plant at Little Common sub-station (£1,490), and at proposed station in Terminus Road district (£1,490).—Hewittic Electric Co., Ltd.
L.p cable, agreement renewed for six months.—Enfield Cable Works, Ltd.

**Colchester.**—Town Council. Accepted:—
20,000 yards of e.h.p. cable and 3,800 yards of l.p. cable (£13,042).—W. T. Henley's Telegraph Works Co., Ltd.
Portable centrifugal oil purifier and equipment (£90).—Alpha-Laval Co., Ltd.

**Croydon.**—Tramways Committee. Recommended:—
106 tons of steel girder rails (£10 16s. 9d. per ton).—Dorman Long & Co., Ltd.
Electricity Committee. Accepted:—
Centrifugal pump.—Pulsometer Engineering Co., Ltd.
Wiring at new switchhouse (£398).—Mr. Wingfield.

**Eltham.**—Accepted:—
Installing electrical fittings and wiring at a new school in Henwick Road, Eltham (£763).—W. H. Gaze and Sons, Ltd.

**Government Contracts.**—The following contracts were placed by various Government Departments during April, 1930:—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Dry batteries.—Siemens Bros. & Co., Ltd.
Boiler.—Yarrow & Co., Ltd.
Section distribution boxes.—Engineering & Lighting Equipment Co., Ltd.; Whipp & Bourne, Ltd.; Hawkers, Ltd.; William McGeoch & Co., Ltd.; Telford, Grier & Mackay, Ltd.; Park Royal Engineering Co., Ltd.
Electric cable.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.; Enfield Cable Works, Ltd.; Johnson & Phillips, Ltd.; St. Helen's Cable & Rubber Co., Ltd.; W. T. Glover & Co., Ltd.
Electric crane.—Cowans, Sheldon & Co., Ltd.
Pneumatic hammer.—Alldays & Onions, Ltd.
Electric lamps.—General Electric Co., Ltd.
Electrification of drainage pump.—Fullerton, Hodgart and Barclay, Ltd.
Switchboards and spares.—Park Royal Engineering Co., Ltd.
W/t valves.—Mullard Radio Valve Co., Ltd.; General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.

WAR OFFICE.

Transformers, &c.—W. Mackie & Co., Ltd.

AIR MINISTRY.

Batteries.—Siemens Bros. & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Air compressor plant.—Belliss & Morcom, Ltd.
Cables.—British Insulated Cables, Ltd.; N. Hingley and Sons, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Circuit breakers.—Metropolitan-Vickers Electrical Co., Ltd.
Electrical equipment.—J. Stone & Co., Ltd.
Electric meters.—Ferranti, Ltd.
Overhead line materials.—Bullers, Ltd.
Pumping plant.—Tangyes, Ltd.
Signalling materials.—Westinghouse Brake & Saxby Signal Co., Ltd.
Superheater elements.—Superheater Co., Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.; Electric Control, Ltd.; English Electric Co., Ltd.
Telephones.—Ericsson Telephones, Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.
X-ray equipment.—Schall & Son, Ltd.

POST OFFICE.

Protective apparatus.—Phœnix Telephone & Electric Works, Ltd.
Telegraphic apparatus.—Creed & Co., Ltd.; Automatic Telephone Manufacturing Co., Ltd.
Telephonic apparatus.—Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Hall Telephone Accessories (1928), Ltd.; Plessey Co., Ltd.; Standard Telephones and Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Manufacturing Co., Ltd.
Wireless apparatus.—Westinghouse Brake & Saxby Signal Co., Ltd.
Telephone cabinets.—Boulton & Paul, Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Standard Telephones & Cables, Ltd.
Leclanché porous cells.—Edison Swan Electric Co., Ltd.; Fuller Accumulator Co. (1926), Ltd.; General Electric Co., Ltd.; India Rubber, Gutta Percha & Telegraph Works Co., Ltd.; Le Carbone; Siemens Bros. & Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Cords for telephones.—Phœnix Telephone & Electric Works, Ltd.; Reliance Electric Wire Co.
Desks.—Ericsson Telephones, Ltd.
Dynamotors.—Walter Jones & Co.
Condenser paper.—Brittains, Ltd.
Insulated staples.—Tower Manufacturing Co., Ltd.
Flameproof wire.—British Insulated Cables, Ltd.
Manufacture, supply, drawing-in and jointing cable, London-Liverpool (London-Fenny Stratford and Fenny Stratford-Birmingham sections). — Standard Telephones & Cables, Ltd.; Reading-Newbury.—Siemens Bros. & Co., Ltd.
Electric lift, Cardiff Head Post Office.—J. Bennie, Ltd.
Fire-alarm system, L.C.C.—Standard Telephones & Cables, Ltd.
Telephone exchange equipment: Temple Bar (London, W.C.).—Standard Telephones & Cables, Ltd. Bishopsgate (E.C.) and Walthamstow (E.).—Automatic Telephone Manufacturing Co., Ltd. Edgware and Sanderstead (Croydon).—General Electric Co., Ltd.; Sub-contractors for Sanderstead: Crompton Parkinson, Ltd., for motor generators and ringing machines, and D.P. Battery Co., Ltd., for batteries.
Telephonic repeater equipment, Manchester.—Standard Telephones & Cables, Ltd.

METROPOLITAN POLICE.

Installation of electric lift, Barnes workshop.—Waygood-Otis, Ltd.

**Grimsby.**—Highways Committee. Recommended:—
Automatic traffic control signs (£458).—Forest City Electric Co.

**London.**—London County Council Education Committee. Electric light installation at Henwick Road school, Woolwich :

| | |
|---|---|
| W. H. Gaze & Sons, Ltd. (Accepted) ... ... | £763 |
| T. Clarke & Co., Ltd. ... ... ... ... | 803 |
| Alexander Hawkins & Sons ... ... ... | 829 |
| Woolwich Metropolitan Borough Council ... | 835 |
| Leonard G. Tate & Co., Ltd. ... ... ... | 845 |
| Electrical Installations, Ltd. ... ... ... | 851 |
| Eastern Armature Winding Co. ... ... ... | 862 |
| J. Briggs (Electrical Contractors), Ltd. ... | 920 |
| A. Dean & Co., Ltd. ... ... ... ... | 929 |
| Burdette & Co., Ltd. ... ... ... ... | 1,050 |
| Malcolm & Allan (London), Ltd. ... ... ... | 1,236 |

Electric lighting at two nursery schools, Mile End :

| | |
|---|---|
| A. Dean (Accepted) ... ... ... ... ... | £246 |
| J. Briggs ... ... ... ... ... | 251 |
| H. J. Cash & Co., Ltd. ... ... ... ... | 281 |
| Electrical Installations, Ltd. ... ... ... | 283 |
| Burdette & Co., Ltd. ... ... ... ... | 353 |

Installation of eleven motors at School of Building, Hammersmith (£277).—Brook Motors, Ltd. (Recommended).

Stepney.—Electricity Supply Committee :—
Condenser tubes for No. 1 turbo-generator (£1,747).—Yorkshire Copper Works, Ltd. (Accepted.)
Baths and Wash-house Committee :—
26-in. electrically driven self-balancing hydro extractor (£105).—J. J. Lane, Ltd. (Recommended.)

Hammersmith.—Electricity Committee :—
E.h.p. switchgear in connection with the three 11,000-V. cables between the generating station and Scrubbs Lane sub-station (£2,677).—General Electric Co., Ltd. (Recommended.)

**South Africa.**—Cape Town.—Electricity Committee. Accepted :—
Self-synchronising equipment for two convertors (£2,8[illegible].—Bruce Peebles & Co., Ltd.
House service meters, "Measurement" type (£2,475).—Associated Engineers Co., Ltd.

**Southend-on-Sea.**—Town Council. Accepted :—
Electrically-driven pumps for fountains (£248).—General Electric Co., Ltd.

**Taunton.**—Town Council. Accepted :—
25,000-lb. boiler, complete with auxiliary plant (£7,028).—Babcock & Wilcox, Ltd.
Motor-driven boiler feed pump and all accessories (£267).—Mather & Platt, Ltd.

**Warrington.**—Housing Committee. Accepted :—
Wiring 260 houses at Westy estate (£6 1s. per house).—H. Lilley.

# Notes.

## The Consular Service.

Sir Edward T. F. Crowe, C.M.G. (Comptroller-General of the Department of Overseas Trade) was the principal guest of the Batti-Wallahs' Society at its luncheon held on May 22nd at the Hotel Metropole, London. The chairman of the Society, Mr. W. McClelland, C.B., O.B.E., presided over a company of about 90 members and guests.

Sir Edward, speaking of the consular service in relation to trade, said that consuls did not always receive the credit to which they were entitled. If they did not help trade as much as they might that was because full advantage was not taken of the consular service. As long ago as 1848 a Parliamentary debate had made it clear that consuls were expected to make trade openings, and this part of their duties had become of increased importance since the war. They could not, however, sell goods; they were not commercial travellers. They had to mix with all classes of people to obtain information, which often meant putting two and two together. Though it was not intended that they should supply information for the benefit of the foreigner, that was sometimes the actual outcome of their work, as the merchants of other nations were very eager to secure British consular reports. There had been a greater sale of the Balfour Report abroad than at home. If manufacturers desired to make headway in a foreign country, they should read everything pertaining to that country. Consuls had many duties to fulfil other than commercial, and Sir Edward gave several amusing examples of the kind of work calling for those qualities with which the British race was held to be especially endowed. He urged that parents seeking a profession for a boy should consider the consular service and offered to give any information on the subject that his experience in the service enabled him to impart.

Mr. F. Pooley (past-president) thanked Sir Edward Crowe on behalf of those present for his stirring address.

Mr. M. Whitgift, honorary secretary, announced that the next luncheon would be held in October.

## Association of Public Lighting Engineers.

On his retirement from the secretaryship of the Association of Public Lighting Engineers, the Council is to make a presentation to Capt. W. J. Liberty in recognition of the splendid services he has rendered to the Association since its inception. Members' subscriptions may be sent to the president, Mr. S. B. Langlands, inspector of lighting, Corporation Lighting Department, Tontine Buildings, 20, Trongate, Glasgow, C.1.

## The Scottish Grid.

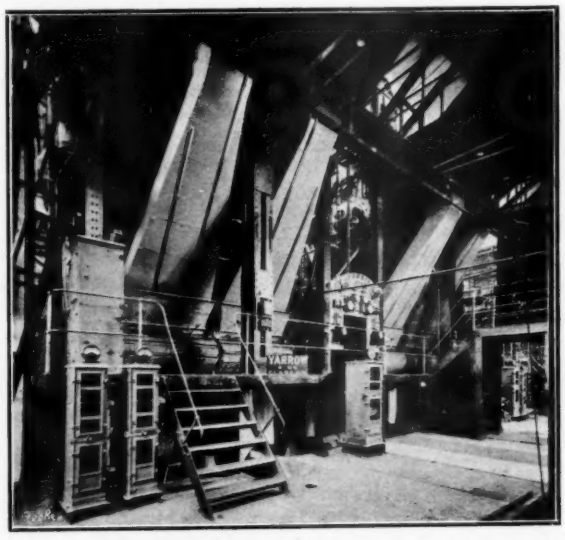
Referring to the leaderette under the above heading in our last issue, May 23rd, p. 942, it should be understood that it was not our intention to attribute the manufacture of the insulators upon which we commented favourably to Steatite and Porcelain Products, Ltd. Actually we are informed that the insulators in question were supplied by British Porcelain Co., Ltd.

## The Domestic Rate.

Mr. C. M. Johnston, M.I.E.E., M.I.Mech.E., engineer and manager of the Borough of Shrewsbury electricity works, informs us that electricity is supplied by his undertaking at 1d. per kWh for heating and cooking purposes. There is a 10 per cent. discount to consumers of over 1,000 kWh per quarter. Shrewsbury should, therefore, be added to the number of towns listed in the special supplement to our issue of April 11th.

## Association of Supervising Electrical Engineers.

The happy and interested relationships which have existed between the Association of Supervising Electrical Engineers and its presidents is reflected in the statement that Mr. S. B. Donkin has accepted the invitation of the Board of Control of the Association to continue as president for a further and third consecutive year.



**The Two New 75,000-lb. "Yarrow" Boilers at the Brighton Power Station.**

(Referred to on p. 1016 in the article on "Recent Developments at Brighton").

## Appointments Vacant.

Plumber-jointers for the Swansea Electricity Department.
Plumber cable-jointer for the Felixstowe Electricity Department.
Shift engineer for the Bradford Electricity Department.
Temporary draughtsmen for the Walthamstow Urban District Council.
Chief clerk and works accountant for Spalding Electricity Department.
Mains assistant for Birmingham Electric Supply Department.
Lady demonstrator of domestic electrical apparatus for Southampton Electricity Department.
Mains assistant for Walthamstow Electricity Department.
Mains engineer for Croydon Electricity Department.
Jointer-linesman for Holywood Urban District Council.
(See our advertisement pages to-day.)

## The Commissioners' Return for April.

The official returns rendered to the Electricity Commissioners show that 837 million kWh of electricity were generated by authorised undertakers in Great Britain during the month of April, as compared with 807 million kWh in the corresponding month of 1929, or an increase of 3.7 per cent. During the first quarter of 1930 the total amount of electricity generated by authorised undertakers was 3,017 million kWh, as compared with 2,844 million kWh for the corresponding quarter of 1929, representing an increase of over 6 per cent.

The Commissioners propose to issue a similar statement each month.

## Racing-track Lighting.

Advantage was taken during the recent reconstruction of the racing tracks at the White City, Manchester, to improve the lighting of the tracks. For the dirt track skirted dispersive reflectors by the Wardle Engineering Co., Ltd., with 1,500-watt "Cryselco" lamps are used, spaced 15 ft. apart and 15 ft. high, and "Wardle" intensive reflectors, with 1,000-watt "Cryselco" lamps, spaced 30 ft. apart and 17 ft. high, are installed over the dog track, fig. 1. A feature of the installation is the new automatic starting system installed at the

**Fig. 1.—Dog-track Lighting; White City, Manchester.**

dirt track. Six "Wardle" avenue-lighting units, fig. 2, are fitted to a girder extending above the track. The globes of these units are coloured red, white, blue, yellow, pink, and black and white, and beneath these the riders, wearing corresponding colours, commence the race. Should a rider fall or retire, his light will be extinguished. Beneath each of the units is mounted horizontally a "Wardle" traffic signal, the beacon lights being white, amber and red. White is the starting light, which replaces the starting flag. In the case of a handicap, each man starts as his white light appears. In the case of a rolling start, all white lights show, except in the case of a false start, when the red signals round the track are switched on. No change takes place until the rider passes the post entering on his third lap; the white signal then

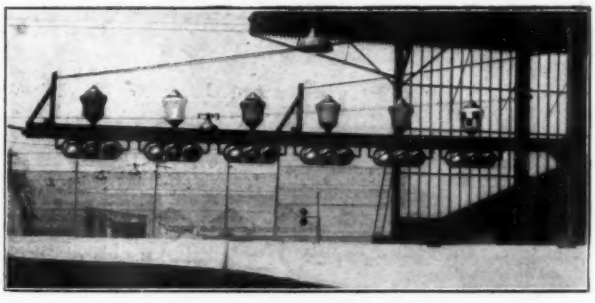


**Fig. 2.—Automatic Starting System Equipment.**

changes to amber. Upon entering his last lap, the amber changes to red, denoting the fourth and last lap. From the rider's point of view he is a lap behind the spectators in seeing the amber signal. He sees it when entering the fourth lap; the amber then changes to red, which he sees when coming down the final straight at the end of the fourth lap, denoting he is finishing. "Cryselco" rough-service 60-watt lamps are used in these signals. This new signalling system has been working since the opening of the season, and has proved satisfactory to all concerned.

## I.E.E. Golf Competition.

The annual golf competition for the G. P. Dennis trophy and other prizes was held at the Prenton Golf Club on May 22nd. The total entries numbered 118, and many good cards were returned. In the bogey competition for the trophy, Mr. F. G. Briant was the winner with a score of 1 up.

In the Class A handicaps (13 and under), Mr. J. Boucher took the first prize with a score 84-12-72, and Mr. J. McKinzie the second prize with a score 84-11-73.

In the Class B handicaps (14 and over), Mr. G. G. L. Preece tied with Mr. P. N. Rand with scores 90-14-76, and they were awarded 1st and 2nd prizes.

In the foursomes, Mr. S. E. Britton and Mr. T. C. Griffiths won the first prize with a score 91-15-76, and Mr. Bertram Thomas and Mr. C. Howarth won the 2nd prize with a score 89-10¼-78¼.

Mr. C. Stephens and Mr. J. A. Morris took the first and second prizes in the putting competition with scores of 35 and 36 respectively.

Mr. T. B. Morgan presided at the dinner at the club house and presented the prizes, which had been given by British Insulated Cables, Ltd.; British Thomson-Houston Co., Ltd.; Callender's Cable and Construction Co., Ltd.; Edison and Swan Electric Co., Ltd.; English Electric Co., Ltd.; General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; and other friends.

It is hoped that it will be possible, due to the generosity of many friends, to hand over a very substantial amount to the I.E.E. Benevolent Fund.

## The New Argosy Lodge.

On Saturday last at the Grand Temple, Freemasons' Hall, Gt. Queen Street, London, the consecration of the Argosy Lodge, No. 5181, took place, the company present, including founders and visitors, numbering 100. It is very interesting to note that all the first officers and founders, with three exceptions, are connected with W. T. Henley's Telegraph Works Co., Ltd. The three exceptions are also connected with the cable industry. The following are Henley men:—C. A. Grover (Master); J. H. Roberts (S.W.); C. A. Locke (J.W.); F. J. Bettley (treasurer); John S. Simmons (secretary); J. H. Archer (S.D.); J. F. H. Colyer (J.D.); T. H. Smith (A.D.C.); W. H. Nicholls (Almoner); S. J. Ebbutt (organist); E. Bawtree (assistant secretary); F. J. Bostridge (I.G.); J. H. G. Clements, F. C. Walder, W. A. Moore and F. E. Temple (stewards); J. E. Nevill (Tyler); and Bros. T. J. Hudson, A. H. Barnes, A. J. Kips, D. I. Evans, E. L. Chafe, J. A. Cockburn, P. J. Baker, W. A. Bennett, and M. C. W. Miller (Founders). The three non-Henley first officers and founders are W. Bro. R. H. Symonds, P.M. (Acting I.P.M.), from an allied branch of the cable industry; W. Bro. J. Snow Huddleston, P.M. (of the Union Co.) D.C.; and W. Bro. F. E. Phillips, P.M. (steward) (of the St. Helens Cable Co.).

## Engineering Training.

We have received from Messrs. W. H. Allen, Sons & Co., Ltd., a booklet describing the engineering training which is carried out at their works at Bedford. The three distinct schemes of training in vogue are directed to produce: professional engineers capable of taking highly responsible positions on the administrative, executive, technical or commercial sides of the engineering industry; engineers to occupy less responsible, but highly important positions in the industry; and engineering craftsmen in all the various trades included in engineering and allied occupations. The schemes have been evolved from actual experience of the training of young men extending over half a century, and it is believed that they not only embody all the advantages of the original "Allen" pupilage and apprenticeship, but that in their present form they will meet all the requirements of modern engineering practice.

## The Electrical Association for Women.

The fifth annual report of the E.A.W. (July, 1929-May, 1930) expresses gratification at the progress made. The Association has become stronger numerically and in the number of branches established. The first conference organised by the Association outside of London was held at the North-East Coast Exhibition, Newcastle-on-Tyne, last year, and proved to be a great success. For the first time in the history of electrical development, women of different nationalities occupied a common platform and spoke of the progress of electricity in their respective countries.

The policy of the Association in giving freedom to its branches to conduct their own affairs has proved to be very wise, and, with a single exception, all the local organisations are in a very flourishing condition. Many visits to places of electrical interest and some first-class lectures have been enjoyed. The Social Sub-Committee, under the chairmanship of Mrs. Llewelyn B. Atkinson, continues to arrange very successful social afternoons and evenings at the Club Room in London.

During the early spring the first Home Electrification Course was arranged jointly by the E.D.A., E.L.M.A. Lighting Service Bureau and the E.A.W. This largely attended course was designed to give women working in the electrical industry an acquaintance with the modern developments in practical domestic electrification.

Following on the deputation to the Board of Education last June, the Association has been in touch with local education authorities with a view to establishing simple instruction on home electrical appliances and representations have also been made to electrical authorities on the need for their co-operation in securing better electrical equipment in schools. The Board of Education has decided to run a special summer school for domestic science teachers during the first fortnight in August, on the applications of electricity in the home, at Berridge House, London. Miss C. Haslett, E.A.W. Director, has been appointed organiser of the course, and the lecturers will include Miss M. M. Partridge, Miss Anna Holm, Lt.-Col. W. A. Vignoles, Mr. W. S. Jones and Mr. A. P. M. Fleming.

The Director of the Association has been appointed to the Committee set up by the Electricity Commissioners on Electricity Supply in Rural Areas to represent the women's point of view, and during the autumn, at the request of the Committee on Tariffs set up by the Electricity Commissioners, the Association sent a small deputation to give evidence on the woman's point of view.

The Association last February staged an educational play, entitled "'Watts' in a Home."

*The Electrical Age* (editor, Miss C. Haslett) is increasing its circulation and is finding its way to many parts of the world. The journal is entirely self-supporting, and is, in fact, bring-

ing in a small revenue to the work of the Association. The Association is enrolling a number of overseas members, and thanks Mr. E. E. Sharp for many introductions from Australia and New Zealand.

A tribute is paid to the many electrical, educational, and women's organisations which continue to support the E.A.W. work.

### The North London Tube Scheme.

The Select Committee of the House of Lords, which has been considering the Bill promoted by the Underground Group for the extension of the Piccadilly tube northwards, approved the preamble of the Bill on Tuesday last. As the measure has already passed the House of Commons it will now receive the Royal Assent shortly and tenders for the work will be invited immediately thereafter.

### Electricity for Domestic Purposes in the Irish Free State.

The Irish Free State Electricity Supply Board is now undertaking the work of teaching householders how to cook by electricity, and how to make the best use of electrical apparatus for domestic purposes. To carry out this system effectively a "Home Service Department" has been established by the Board. Householders are being educated into the manner of making the best use of the facilities offered by electricity for alleviating and improving domestic labours. Experts are being supplied to various centres for this purpose, and where area managers have been appointed, practical demonstrations are publicly given for the benefit of householders.

### Institution of Electrical Engineers.

North-Eastern Centre.—The annual report of the Committee on the thirtieth session (1929-30) presented at the annual general meeting at Newcastle-upon-Tyne on April 14th showed that 14 meetings were held at which the average attendance was 73, compared with 85 during the previous session; the Faraday lecture was attended by 942 people, of whom 82 were members. The membership of the Centre increased by 22 to 529, including the Tees-side Sub-Centre membership, which was 22 per cent. of the whole. The officers for the 1930-31 session are: *chairman*: Mr. B. H. Leeson; *vice-chairmen*: Messrs. A. G. Shearer and C. Turnbull; *Committee*: Messrs. D. M. Buist, J. Cusworth, V. A. Pask, E. H. E. Woodward, T. Carter, H. Paterson, A. T. Robertson, J. Rosen, W. M. Armstrong, A. B. MacLean, R. W. Gregory, F. C. Winfield, F. G. C. Baldwin, G. F. Bellwood, and Dr. W. M. Thornton; *hon. secretary*: Mr. H. B. Paynder.

Tees-side Sub-Centre.—The average attendance at the seven meetings increased, apart from works visits and social functions. The Committee is as follows: *chairman*: Mr. H. G. A. Stedman; *vice-chairmen*: Messrs. A. Storey and E. E. Dunn; *committee*: Messrs. T. M. Ayres. R. A. Cartland, E. K. Charles, W. R. Cooper, E. Edwards, W. A. Gallon, R. J. Huntley, F. A. Lay. W. Ramsdale, D. J. E. Richards, J. I. Smith, and W. Wingate; *hon. secretary*: Mr. D. B. Hogg.

N.-E. Students' Section.—The membership increased from 116 to 160. Some 15 meetings were held.

### Engineers in Queensland.

Corporate membership of the British Institution of Electrical Engineers is one of the qualifications that entitle to registration under the Professional Engineers' Act (Queensland) Australia.

# Our Personal Column.

**Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.**

At a recent meeting of the Tramway and 'Bus Committee of the Morecambe Corporation it was reported that Mr. J. Wild, who was recently appointed general manager, had decided to remain in his old position, and the Committee therefore recommended the appointment of Mr. H. B. Sharpe, of Rotherham.

The General Purposes Committee of the Brighton Town Council last week recommended the appointment of Mr. William N. C. Clinch (resident engineer at the Brimsdown station of the North Metropolitan Electric Power Supply Co.) as chief electrical engineer, in succession to Mr. John Christie, at a salary of £1,600 per annum. The recommendation was to come before the Town Council yesterday (Thursday). There were fifty applicants for the post.

Mr. H. G. W. Haslett has been appointed sales manager (electrical products) to Messrs. Chesterton, Jones & Co., Ltd., Tyseley, Birmingham, manufacturers of the "David" and "Davidson" electrical appliances. Mr. Haslett has been London sales engineer, heating and cooking section, for the Credenda Conduits Co., Ltd., for many years.

Mr. D. H. Bonnella, the founder of D. H. Bonnella & Son, Ltd., celebrated his 90th birthday on April 26th last, and to mark the occasion the services of those employés who had been with the firm five years and over were suitably recognised, while the clerical staff and works superintendents were entertained at dinner at the Trocadero Restaurant and afterwards at the Coliseum on May 21st. Mr. A. J. Bonnella, managing director, presided in the unavoidable absence of Mr. D. H. Bonnella. The toast of the evening was proposed by Mr. W. H. Farthing, who has been in the service of the firm for 29 years. Mr. D. H. Bonnella continues to enjoy fairly good health, and only ceased attending the office daily about 2½ years ago.

The Carlisle Town Council has adopted a recommendation by the Electricity Committee to award the city electrical engineer (Mr. C. W. Salt) £1,075 for services rendered by him in connection with extensions at the new works.

The Fulham Electricity Committee recommends the appointment of Mr. G. W. Morgan, of Croydon, as junior mains assistant at a salary of £306 per annum.

In Philadelphia, U.S.A., on May 22nd, the Franklin Institute presented the Franklin Gold Medal to Sir William Bragg in recognition of his work in the sphere of physical science.

The Association of Mining Electrical Engineers has awarded a gold medal to Mr. S. B. Haslam for a paper read before the South Wales branch last session.

Mr. F. S. Mockford who has had charge of the wireless station at the Croydon Air Port for the past eleven years has relinquished that position to join Marconi's Wireless Telegraph Co., Ltd.

The President of the Board of Trade has appointed Alderman E. B. Lewis, J.P., president of the National Chamber of Trade, as an additional member of the Committee recently set up, under the chairmanship of Lord Chelmsford, to examine the present situation as regards the British Industries Fair, and to consider what means can be adopted to increase still further its utility to British Trade.

The April *Journal* of the British Chamber of Commerce, Shanghai, reports that Mr. F. R. Marsh has resigned his position as manager of the Hongkong Electric Co., Ltd.

Mr. W. B. Woodhouse, general manager of the Yorkshire Electric Power Company, has been elected to the Council of the University of Leeds.

Mr. W. B. Phelp, managing director of the British General Electric Co., Ltd., South Africa, has arrived in England on a visit.

It was announced at last week's meeting of the Overhead Lines Association that Mr. W. C. Bexon, chief engineer and manager of the Ayrshire Electricity Board, had been nominated by the Council for the presidency of the Association. Mr. Bexon contributes an article on "The Economics of Rural Electrification" to this issue.

Mr. H. Bannister, A.M.I.E.E., has resigned from the staff of the Yorkshire Electric Power Co., where for six years he has held the position of sub-station construction superintendent, to take up an appointment with the Central Electricity Board, London. Mr. Bannister has been presented by his late colleagues with a suitably inscribed grandmother clock.

The Bedford Town Council has fixed the salary of the borough electrical engineer (Mr. R. W. L. Phillips) at £1,195 per annum as from April 1st last, on account of the undertaking's increased output.

The Battersea Electricity Committee has considered 124 applications for the appointment of commercial assistant engineer and has appointed Mr. H. E. Betts, who for the past seven years has been assistant sales engineer in the Bradford Electricity Department.

Mr. A. E. Newburn, of Rochdale, has been appointed mains superintendent in the Walsall Electric Supply Department.

# Financial Section.

**New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.**

## New Companies Registered.

**Majestic Electric Co., Ltd.**—Private company. Registered May 23rd. Capital £10,000 in £1 shares. Objects: To act as agents for the sale and distribution of radio receivers, gramophones, telegraphic and telephonic apparatus, valves, electrical, magnetic and radio-active instruments, switchboards, &c. The subscribers are: W. C. Langford, 39, Salisbury Road, Redland, Bristol, clerk; F. A. Marks, 6, Ainslies Belvedere, Landsdown Road, Bath, clerk. Solicitors: Wansbroughs, Robinson, Taylor and Taylor, Lion Chambers, Broad Street, Bristol.

**Paget Radio Co., Ltd.**—Private company. Registered May 21st. Capital £100 in £1 shares. Objects: To carry on the business of wireless, electrical and mechanical engineers and contractors, manufacturers of and dealers in electrical, magnetic, galvanic and all other apparatus connected with wireless, &c. The directors are: J. G. Guy, 51, Pentrebane Street, Cardiff; A. Smith, 38, Paget Street, Cardiff.

**B. D. & Co., Ltd.**—Private company. Registered May 21st. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in radio and electrical instruments and precision tools, mechanical and electrical engineers, &c., and to adopt an agreement with G. E. A. Boynton, H. C. G. Boynton and Florence M. Boynton. The first directors are: G. E. A. Boynton, and H. C. G. Boynton, 24, Ellington Road, Muswell Hill, N.10, mechanical engineers; E. A. Rich, 21, Stapleton Hall Road, Stroud Green, N.4. Registered office: 167 to 173, Goswell Road, E.C.1.

**General Resistors, Ltd.**—Private company. Registered May 21st. Capital £5,000 in £1 shares (1,500 5 per cent. cumulative preference and 3,500 ordinary). Objects: To carry on the business of electricians, and manufacturers of and dealers in electrical apparatus and machinery. The subscribers are: A. J. Summerfield, 19, Woodward Street, Nottingham, solicitor's clerk; A. H. Downs, 189, Exchange Road, West Bridgford, Notts, solicitor's clerk. Secretary: S. Hill. Registered office: Old Radford Works, Ilkeston Road, Nottingham.

**Stuarts (Radio), Ltd.**—Private company. Registered May 17th. Capital £1,000 in £1 shares. Objects: To carry on the business of cycle, motor, gramophone, wireless, electrical and general storekeepers, &c. The directors are: H. P. Richardson, Tudor Lodge, The Drive, Westcliff-on-Sea, electrical engineer (director of Stuarts (Westcliff-on-Sea), Ltd.); Mrs. L. G. Richardson, Tudor Lodge, The Drive, Westcliff-on-Sea; H. Richardson, 494, London Road, Westcliff-on-Sea, electrical engineer (director of Stuarts (Westcliff-on-Sea), Ltd.). Solicitors: Herbert J. C. Sumpter & Co., 5, Robert Street, Adelphi, W.C.2. Registered office: 82, Markhouse Road, Walthamstow, E.17.

## Official Returns of Electrical Companies.

**Alpha Manufacturing & Electrical Co., Ltd.**—Mortgage on 26, High Road, Balham, S.W.12, with fixtures, &c., dated April 22nd, 1930, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

**Upfields Wireless, Ltd.**—Capital, £300 in £1 shares. Return dated April 22nd, 1930. All shares taken up. £300 paid. Mortgages and charges, £1,000.

**Bann Syndicate, Ltd.**—Capital, £10,000 in £1 shares. Return dated January 14th, 1930. 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

**Empson Electrical Engineering Co., Ltd.**—Capital, £2,000 in £1 shares. Return dated December 23rd, 1929. All shares taken up. £500 paid. £1,500 considered as paid. Mortgages and charges, nil.

**Electric Transmission, Ltd.**—Capital, £10,000 in £1 shares. Return dated February 20th, 1930. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

**Great Western Ignition Co., Ltd.**—Capital, £2,000 in £1 shares. Return dated April 16th, 1930. 950 shares taken up. £950 paid. Mortgages and charges, nil.

**North Metropolitan Power Station Co., Ltd.**—Capital, £100 in £1 shares. Return dated March 11th, 1930. All shares taken up. £100 paid. Mortgages and charges, £850,000.

**Thermo-Path Co., Ltd.**—Capital £3,260 in 3,069 preference shares of £1 and 3,820 ordinary shares of 1s. each. Return dated November 29th, 1929. All shares taken up. £3,114 paid. £146 considered as paid. Mortgages and charges, nil.

**Newport Electrical Co., Ltd.**—Capital £2,000 in £1 shares. Return dated July 10th, 1929 (filed March 11th, 1930). 20 shares taken up. £76 paid. £666 considered as paid. Mortgages and charges at date of return, nil. Since registered: Debenture dated January 3rd, 1930, to secure £400. A return of allotments, made up to January 3rd, 1930, shows a further 121 shares allotted as fully paid as consideration for the purchase of the business of E. C. Winter.

**Galliers (Wholesale), Ltd.**—Capital £1,000 in £1 shares Return dated December 31st, 1929 (filed February 24th, 1930). 100 shares taken up. £50 paid. £50 calls unpaid. Mortgages and charges, nil.

**E. Saunders (Margate), Ltd.**—Capital £3,000 in £1 shares. Return dated July 10th, 1929 (filed March 11th, 1930). 20 shares taken up. £20 paid. Mortgages and charges, nil.

**Gayton Park Electricity Co., Ltd.**—Capital £3,000 in £1 shares. Return dated July 9th, 1929 (filed May 8th, 1930). All shares taken up. £3,000 considered as paid. Mortgages and charges, nil.

**Rubon, Ltd.**—Capital £100 in £1 shares. Return dated December 31st, 1929. Two shares issued and fully called up. Mortgages and charges, £500.

**Electrohomes, Ltd.**—First debenture dated May 13th, 1930, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: D. H. Smith, 18, York Avenue, East Sheen.

**Stella Lamp Co., Ltd.**—Satisfaction to the extent of £12,000 on February 18th, 1930, and to the extent of the balance of £3,500 on May 1st, 1930, of debentures authorised May 15th, 1922, and registered June 14th, 1922. (According to the register of mortgages, the debentures registered June 14th, 1922, originally secured £23,500).

## City Notes.

### Siemens Bros. & Co., Ltd.

The annual meeting of this company was held on May 22nd, Lord Queenborough (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, May 23rd, p. 969) the chairman referred to Caxton Electric Developments, Ltd., a subsidiary, which he stated had assets of £670,000. Referring to progress made during the year under review, he stated that with the exception of submarine cables, all departments were well occupied throughout the year. Contracts, however, had frequently to be accepted at unremunerative prices in order to reach a high level of productive efficiency by the plant being kept fully employed. The overseas markets, chiefly due to foreign competition, were very difficult. They were, however, holding their own in these fields, despite the assistance given in diverse ways by foreign Governments to their export trade. Apart from keen competition, in view of the political situation in India, the financial position in Australia and New Zealand and the high tariffs that had recently been imposed by Australia on imported goods, the prospects for the current year for increased exports were not favourable. Considerable experimental and research work had been carried out in connection with submarine telephone cables with very promising results, and it was hoped that the Government would place contracts in this country for submarine cables for the proposed telephone cable service between this country and the United States. Contracts carried out during the year included a telephone link between the mainland and the Isle of Man, and from the Isle of Man to Northern Ireland. Another submarine telephone cable was supplied to British Columbia. The demand by the British Post Office for subscribers' cable

was maintained. A large order was received for h.p. mains for Australia, which consisted of 645 drum lengths of 3-phase, 33,000-V cable weighing about 5,000 tons. Other important h.p. cable contracts carried included those for Bristol and Hull Corporations. Contracts received from the G.P.O. during the year included three exchanges for the London area and exchanges and extensions in a number of provincial areas. They had also a large number of overseas contracts in hand, including an 8,500-line automatic exchange for Lisbon. This would be the first public automatic exchange installed in Portugal. The "Neophone" telephone had been adopted by a number of British overseas and foreign administrations. The demand for heavy work had been well maintained and that for radio batteries had increased. A contract had been received for one of the overhead schemes in connection with the Grid. Siemens Electric Lamps & Supplies, Ltd., a subsidiary, had for several years past made continued progress and was now an important factor in the company's business. The report and accounts were adopted.

### Electramonic Co., Ltd.

An extraordinary meeting has been called for June 11th at which the directors will submit a scheme for the liquidation of the company with a view to reconstruction. It is proposed that preferential creditors and creditors for £10 or less shall be paid in full, while creditors for over £10 will receive 10s. in the £. The holders of the existing 10s. preferred ordinary shares will be allotted one 10s. preferred ordinary share in the new company for each share held credited as paid up to the extent of 6s. 8d. Holders of deferred shares will receive an equal number of the new company's deferred shares credited 8d. paid up. The balance of payments will be spread over two months.

### Electric Furnace Co., Ltd.

The second annual report covering the year ended March 31st last shows a net profit of £13,520, to which is added £1,586 brought forward, making £15,106. It is proposed to pay a dividend of 7 per cent. on the ordinary shares, and a final dividend of 3½ per cent., on the preferred ordinary shares, making 7 per cent. for the year, leaving £4,043 to be carried forward. The report states that the company owns all the shares in the Electric Resistance Furnace Co., Ltd., which was formed during the year. The total value of unfinished orders on the books at the end of the year was well above the average, and the total value of orders received constitutes a record. Every effort has been made to study new applications of electricity to melting and heating problems, and during the year installations have been undertaken in England, Scotland, France, Spain, Algiers and Brazil, in connection with the steel, iron, brass, copper, nickel, silver, gold, &c., industries. It is proposed in future to pay dividends on January 1st and July 1st.

### Cable, Telephone & General Trust, Ltd.

A statement of the company's constitution and objects was published last week, for information only. This showed an authorised capital of £1,100,000, of which £698,737 has been issued. The company is an investment trust formed in 1926 and is associated with the International Automatic Telephone Co., Ltd., the Automatic Telephone Manufacturing Co., Ltd., British Insulated Cables, Ltd., and other important British interests, as well as the Associated Telephone and Telegraph Co., of the United States. By these associations investments are made in telephone operating companies, long-term credits are arranged and manufacturing sales facilitated, "all for the purpose of creating tied house investment and financial and manufacturing business to be divided amongst appropriate associated companies." The ordinary dividends for the past three years have been nil, 4 per cent., and 6 per cent., respectively.

### Richardsons, Westgarth & Co., Ltd.

The annual meeting was held on May 23rd, Mr. R. S. Middleton (chairman) presiding. In presenting the reports and accounts (ELECTRICAL REVIEW, May 23rd, p. 968) the chairman said that under the conditions of trading which had prevailed during the past year it had been impossible to make ends meet. Not only had the total amount of work obtainable still further fallen off, but prices had receded to a lower level than ever, due to the intense competition for such orders as had been given out. On the land side of their business, the work completed included two large condensing plants for the London Power Co., Ltd., and turbo-generator sets and condensing plant for the Douglas (I. of M.) and Taunton Corporations. The volume of that work was approximately 20 per cent. of the company's total output for the year. The report and accounts were adopted.

### Lancashire Electric Light & Power Co., Ltd.

The trading profit of the Parliamentary company (the Lancashire Electric Power Co.) for 1929, plus interest, was £257,525, and a balance of £3,186 brought forward is added, making £260,711. After providing for income tax, depreciation, &c., the balance paid over to the Electric Light & Power Co. amounts, with management fees, &c., to £209,872. During the year the company acquired the whole of the share capital of the Ormskirk Electric Supply Co., Ltd., and has received £1,862 therefrom. The company's net balance is £173,109 and £3,308 brought forward is added. An ordinary dividend of 7 per cent. is recommended and £3,806 is to be carried forward. Reference is made in the report to the depression in the textile industry, and it is stated that conditions in the coal industry improved during the latter part of the year and the company made satisfactory progress in other directions. In October last the Kearsley station was put into commercial operation. An issue of 600,000 ordinary shares at 27s. each made in April, 1929, was largely over-applied for. Meeting: June 2nd.

### Kalgoorlie Electric Power & Lighting Corporation, Ltd.

Presiding at the annual meeting on May 22nd, Mr. G. C. Howard (chairman) said the Lake View and Star concern, which controlled the biggest and most important group of mines on the Golden Mile, was actively engaged in developing these properties with satisfactory results, and with promise of opening out further large bodies of profitable ore. Their interests were bound up in the mining industry of the Kalgoorlie field. Whether the developments of that district would enable it to take a much larger quantity of power than they were at present supplying time would tell, but they were in a position to meet all reasonable requirements in the near future. The report and accounts were adopted.

### Iron Trades Employers' Insurance Association, Ltd.

The report for the year ended December 31st last records a premium income of £719,359, to which are added interest, &c., £103,119, and a balance of £59,558 brought forward, making £882,036. Compensation and incidental expenses absorbed £540,014; after providing for management expenses, &c., there is a balance of £263,875. Out of this it is proposed to return 20 per cent. of the Workmen's Compensation premium paid for 1929, together with a bonus of 12½ per cent. on which income tax has already been paid. The report refers to the retirement from the board of Sir William Thom, and the appointment in his place of Lt.-Col. R. K. Morcom. At the annual meeting on May 8th the report and accounts were adopted.

### Chloride Electrical Storage Co., Ltd.

The net profit for the year ended March 31st last was £287,163, as compared with £216,936 in the preceding year. The addition of £69,833 brought forward makes available £356,996. As we have already reported, the dividend on the ordinary shares is raised from 25 to 30 per cent., and in addition a 100 per cent. share bonus is to be issued. The reserve receives £100,000 (against £50,000) and appropriations to employés again amount to £23,000; a balance of £85,824 is carried forward. The share bonus involves the capitalisation of £508,457 of the undivided profits. The meeting is to be held to-day (Friday).

### Direct Spanish Telegraph Co., Ltd.

After meeting all expenses and adding a balance of £1,990 brought forward, the profit for the year ended December 31st last was £12,348. The preference dividend is paid and 8 per cent., free of tax, is distributed on the ordinary shares. £2,000 is transferred to debenture redemption account and £2,176 is carried forward. The Bilbao-Porthcurnow cable, No. 11, became interrupted on June 6th and was repaired on June 13th.

### Aeonic Radio, Ltd.

This company's first report, covering the period from November 16th, 1928, to January 31st last, shows a gross profit of £46,478, but this was reduced by special expenditure of a non-recurring nature of £2,369. It is proposed to reconstruct the company, giving the shareholders the right to take up three 2s. 6d. shares, credited with 2s. paid, for every five 2s. shares now held by them.

### Glenfield & Kennedy, Ltd.

The profit for the year ended March 31st last was £90,649, as compared with £79,296. It is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year, and a bonus of 2½ per cent. The carry forward is £65,028.

### Wemyss & District Tramways Co., Ltd.

The profit for the year ended December 31st, 1929 was £7,283. After deducting interest charges (£7,061), and transferring £200 to debenture stock redemption, a balance of £22 is carried forward. Since the closing of accounts the company has sold its motor omnibus interests.

### Melbourne Electric Supply Co., Ltd.

An interim dividend at the rate of 5 per cent. (actual), free of tax, is announced on the ordinary stock, payable on June 2nd.

### Montreal Light, Heat & Power Consolidated.

A dividend has been declared on the new common shares of 38c. per share for the quarter ending June 30th.

### New "Underground" Capital.

At a meeting on May 22nd, the holders of the Metropolitan District and London Electric Railways Joint Power House 4 per cent. rent charge stock sanctioned the issue of a further £675,000 of the stock. The money is required in connection with extensions and improvements at the Lots Road power station. At present the amount of this stock issued stands at £3,175,000.

### Electric Construction Co., Ltd.

The net profit for the year ended March 31st last was £14,874, as compared with £8,739 in the preceding year. A balance of £5,888 brought forward is added, making £20,762. An ordinary dividend of 5 per cent. is recommended, against 5½ per cent. for 1928-29.

### Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Dorset & Devon Electricity Supply, Ltd.
English Radio Corporation, Ltd.
Radio Components, Ltd.
Rose Bros. Electrical Co., Ltd.

### Sphere Investment Trust, Ltd.

The accounts for the year ended March 31st last show a credit balance of £50,961, to which is added £3,374 brought forward, making £54,335. The reserve receives £10,000, and the directors recommend a dividend of 4½ per cent., less tax on the ordinary shares, leaving £3,272 to be carried forward. Meeting: June 6th.

### Merthyr Electric Traction & Lighting Co., Ltd.

The net revenue for 1929 amounted to £25,278. After deducting expenses, debenture interest, &c., and adding £3,654 brought forward, there is a balance available of £16,076. It is proposed to place £7,000 to reserve, and to pay a dividend of 2½ per cent. on the ordinary shares, leaving £5,951 to be carried forward.

### Weston-super-Mare & District Electric Supply Co., Ltd.

The accounts for 1929 show that after deducting expenses, debenture interest, &c., there was a balance of £27,148, which with £6,149 brought forward makes £33,297. The directors propose to place £15,000 to reserve, and to pay a dividend of 10 per cent for the year, leaving £4,897 to be carried forward.

### Meters, Ltd.

The net profit for the year ended March 31st last fell slightly, from £21,319 to £20,311. The final ordinary dividend is 6½ per cent., maintaining the year's distribution at 9 per cent.

### French Companies.

The *Compagnie Française Thomson-Houston* has issued its accounts for the first year since the formation of the "Alsthom," which was constituted in 1928 with the Société Alsacienne de Constructions Mécaniques to bring about rationalisation in production in various common spheres of manufacturing and thus eliminate mutual competition. Including the balance forward the net profits amount to 28.30 million fr., as compared with 27.70 millions in 1928 and the dividend is maintained at 6 per cent.

The *Compagnie Electro-Mécanique* earned net profits of 18,418,000 fr. in 1929, and the dividend is at the rate of 55 fr. per share. It is now proposed to issue debentures for the nominal amount of 50,000,000 fr. as required.

The *Union d'Electricité*, Paris, reports that the net profits increased from 29.32 million fr. in 1928 to 35.72 millions last year. The dividend is raised from 11 to 12 per cent. on the share capital of 250,000,000 fr.

### German Company.

The *Ferd. Schuchardt Telephone and Telegraph Works* Company, in referring to the transfer of the majority of its shares to the International Telephone and Telegraph Corporation and thence into the hands of the Standard Elektricitäts Gesellschaft, which was formed jointly by the A.E.G. and the American company, states that great advantages are expected from the utilisation of the rights and experience of the American company. The accounts show an increase in the net profits from 90,000 in 1928 to 130,000 marks in 1929, and the dividend is increased from 5 to 6 per cent.

### Austrian Companies.

The *Austrian Siemens-Schuckert Co.* is to pay a dividend of 8 per cent. out of net profits of 3.4 million schillings for 1929, as compared with 6 per cent. and 2.6 million schillings in the previous year.

The *Felten and Guilleaume Co.*, of Vienna, states that a reduction took place in the Austrian deliveries of long-distance cables, although larger orders are now expected in view of the overloading of the lines and the projected construction of duplicate cables. The net profits were 3.23 million schillings, against 3 millions in 1928, and the dividend remains at 12 per cent.

# Stocks and Shares.

TUESDAY EVENING.

IT cannot be said that there is any active business in the Stock Exchange as a whole. The best markets, so far as animation is concerned, are those which deal with gilt-edged stocks and others of the purely investment order. Mild spasms of speculation break out every now and then in some of the American utility shares, and in a few mining sections. But in these the business is largely professional, and the British public continues to maintain an attitude of caution, in spite of the cheap money conditions that prevail, and the expectation that there will be a further reduction in the Bank Rate from 3 per cent. At the root of the public's disinclination to take any active hand in Stock Exchange dealing, there is thought to lie the sluggishness in national trade as a whole. This stagnation has the effect, of course, of forcing money into investment securities, but it also reacts unfavourably upon stocks and shares in companies that are dependent upon industrial conditions throughout the country, and which at present give little indication of improvement.

### Electricity Supply.

The electricity supply market may be said to take its place amongst the gilt-edged departments, at any rate so far as the shares of the London undertakings are concerned. In these, the dividends are practically fixed at the standard rates, although every now and then a pleasant surprise befalls, as in the case of the Metropolitan Electric Supply, which recently raised its dividend from 9 per cent. to 10 per cent. The list of prices is almost unchanged on the week. County of London 6 per cent. preference are a shade harder at 23s., this bringing them into line with County of London preference. No movements have occurred in the list of ordinary shares. Urban ordinary are a little lower at 32s. 6d. ex dividend. In the provincial group, Clyde Valleys are a little lower at 38s. 3d. The Lancashire Electric Light & Power Company has increased its trading profits from £238,400 to £257,000, but as there is a larger amount of ordinary share capital ranking this time for dividend, the latter is reduced to 7 per cent. compared with 7½ per cent. a year ago on the smaller capital. The ordinary dividend, although the rate is less than that of last year, takes £86,800 against £60,000 a year ago. The preference shares, which carry participating rights, and last year received 7½ per cent., will this year get the 7 per cent., fixed dividend. The report refers to the textile trade dispute as having seriously affected the company's output, though conditions in the coal trade improved in later months. Northamptons are better at 48s., a rise of 1s. 6d. Isle of Thanet ordinary remain at 27s. 9d., and the preference at 23s. 9d. Newcastle & District shares are 25s. 9d. Richmonds at 43s. are now ex dividend. British Light & Power have taken up their position at 14s. 6d. Atlas remain about 28s. The preference at 24s. 6d. are ex dividend. The price of the new Scottish Power ordinary shares is practically unchanged at 1s. premium. North Metropolitans eased off to 47s. 9d.

### Cables and Wireless.

The 5½ per cent. preference stock of the Cables and Wireless merger has gone back to 92½, but the "B" ordinary stock is up a point, to 23½. The latter movement is said to be due to repurchases by bears who were unable to carry over their stock last account. The price of the "A" ordinary revolves around 50, at which it is tolerably active, there being a good deal of business doing in the stock. The latest estimate of the possible dividend mentioned here last week is 2½ per cent. Some people claim that if the rate should be no more than this, the price will go back still further. Others maintain that a poor result is already well discounted in the price, and that, whatever happens in the dividend announcement, the probabilities point to a price-recovery when the declaration is out, and uncertainty as to the rate is resolved. Oriental Telephone ordinary at 55s. ex dividend have recovered a shilling of the deduction. Automatic Telephones are unchanged at 37s. 6d. A good deal of interest is aroused by the announcement that negotiations are in progress between the Indian Radio Company and the Indian Government with a view to the establishment of a wireless telephone service between India and the United Kingdom. It is said that the service will be conducted through the British Post Office *via* Rugby. Globe Telegraph and Trust ordinary have lost another 10s., going back to 20½, the holders of the shares evidently having become apprehensive on account of the fall in the prices of Cables and Wireless stocks. The preference shares retain their price at 11½. Marconi Marines are lower at 38s. 9d., following upon their previous week's fall. Canadian Marconis are 27s. 6d., after being somewhat better.

### The Middle East.

Calcutta Tramways have published a satisfactory report, showing good progress in the volume of traffic handled last year. The renewed disturbances, however, in Bombay, in Rangoon and other Indian-Burmese centres, have had the natural effect of restraining business in the shares of the various companies affected by the turmoil. The quoted prices are mostly so nominal as to render their repetition rather misleading for the moment.

## Manufacturing Shares.

General Electrics have eased off to 50s., Associated Electrical Industries to 27s., these movements being associated with talk of American selling. British Aluminium ordinary shares fell 2s. to 43s. Brush ordinary at 120 is ex dividend. It will be noticed that the yield on the money comes to 8¼ per cent., but in spite of this, the investor seems a little shy about taking the stock. Mr. Garcke, the chairman, presiding at the recent annual meeting, said that the business of the company had not undergone any change for the worse—a somewhat negative expression. Siemens are also dull at 24s. 6d., although the nominal price remains unchanged. Some conflict of opinion has developed between the chairman, Lord Queenborough, and Mr. Emil Garcke, on the question of whether or not it is worth a company's while to accept business which promises no prospect of profit. Lord Queenborough said that it is sometimes worth while for a company to undertake contracts at unremunerative prices in order to reach a high level of productive efficiency by a full employment of plant. Siemens's are particularly susceptible to foreign competition, and the chairman did not take a very rosy view of the prospect, having regard to the political situation in India and the financial position in Australia, together with the tariff policy of the latter country. Mr. Garcke, at the Brush meeting, said that the company's earnings would have been less had not the directors sternly rejected offers of business which promised no prospect of profit. Doubtless each contract has to be considered on its own merits, and it is possible that both these experienced speakers may be right in their presentation of the case.

Electric Constructions, the price of which a fortnight ago was run up to 24s. on a rumour that the company is likely to be taken over by one of the bigger groups, have dropped back to 13s. 3d., confirmation of this report being lacking. The company announces a net profit for the year to March 31st last of £14,874. This is an increased profit, but the dividend is to be 5 per cent., as against 5½ per cent. a year ago.

Henleys reacted to 6¼, and the tendency of shares in this section has been towards slightly lower levels. Edison Bell shares have risen 2s. 6d. to 17s. 6d. Philips Incandescent Lamps at 66s. 3d. are 1s. 9d. lower.

## The Cable Trust.

Particulars are published of the Cable, Telephone and General Trust, which is a link in a chain of companies in America, Great Britain and elsewhere for the creation of tied-house investment. The authorised capital is £1,100,000, of which £698,700 is issued. The ordinary dividend was 4 per cent. in 1928, and 6 per cent. in the following year. No doubt a market will be started in the various classes of shares; ordinary, 7 per cent. non-cumulative preferred and 7 per cent. cumulative preference.

## Dollar Stocks.

Montreal Light, Heat and Power shares are ex rights, and at 126 the price, allowing for the deduction, shows little change. American Telephone and Telegraphs are also ex rights, the price of the latter being 22, while the existing shares are quoted at 296. Pennsylvania Light and Power shares remain at 83¼. Brazilian Tractions recovered to 51¼. Hydro-Electric shares are a little better at 47¼, showing a gain of 1¼. International Holdings at 6½ have gone back. Mexico Tramways rose to 26½; other Mexicans show hardly an alteration. Shawinigan Water receded to 77, having been a point or so higher. Business in International shares is quiet to the point of being uninteresting. The Brazilian Traction Company announces net earnings for the year to the end of April of a little over $9,000,000, being about $140,000 more than those in the corresponding period last year. Toronto Power 4½ per cent. debenture stock has gone back to 97. British Columbia Power "A" shares at 43 and the "B" at 21¼ are the turn harder.

## Home Railway Stocks.

In the Home Railway market, the outstanding feature is a rise of 3 points in Underground Electric income bonds to 112. The shares have moved up 6d. to 23s. Holders of the bonds should observe that after the end of June, next month, that is to say, the company has the option to pay off outstanding income debentures at 103. Therefore it behoves proprietors of these bonds to keep a close watch upon the date. The rise in the price of the bonds is due to a persistent demand for the shares, for a purchase of the bonds is, at the present time, the cheaper way of obtaining an interest in the shares. The Underground group, tube, tram and 'bus, claims to be carrying the vast number of 2,500 million passengers in London per annum. No further changes have occurred in Districts or Metropolitans. The Tramways group is equally quiet.

The rubber share market exhibits little inclination to improve, although the price of rubber is a shade above the lowest. Amongst iron and steel shares, Babcock & Wilcox recovered to 58s., it being considered that the previous fall had been overdone. The iron and steel market as a whole is lifeless, the view being held that until national trade improves, it cannot be expected that the companies engaged in the heavy industries will increase their profits materially except through the process of amalgamation, and consequent saving of expenses.

# Share List of Electrical Companies.

### Home Electricity Companies.

| | Nom. | Approx. Dividend. 1928. | 1929. | Price May 27 1930. | Rise or fall | Yield p.c. |
|---|---|---|---|---|---|---|
| Bournemouth and Poole ... ... | £ 1 | 15 | 15 | 57/6xd | — | 5 4 3 |
| Brompton Ordinary ... ... | 1 | 8½ | 8½ | 26/6 | — | 5 5 8 |
| Charing Cross Ordinary ... | 1 | 8½ | 8½ | 27/6 | — | 5 1 10 |
| do. do. 4½% Pref. ... | 1 | 4½ | 4½ | 17/- | — | 5 6 0 |
| Chelsea ... ... ... ... | 1 | 8½ | 8½ | 26/6 | — | 5 5 8 |
| City of London ... ... ... | 1 | 10 | 10 | 33/3 | — | 4 4 6 |
| do. do. 6% Pref.... ... | 1 | 6 | 6 | 23/- | +6d. | 5 4 4 |
| Clyde Valley ... ... ... ... | 1 | 8 | 8 | 38/3 | —6d. | 4 3 9 |
| County of London ... ... ... | 1 | 7 | 10 | 47/6 | —⅛ | 4 4 5 |
| do. do. 6% Pref.... ... | 1 | 6 | 6 | 23/- | — | 5 4 4 |
| Edmundson's 7% Pref. ... ... | 1 | 7 | 7 | 24/6 | — | 5 14 3 |
| Elec. Supply Corporation ... ... | 1 | 11 | 11 | 47/- | — | 4 13 7 |
| Kensington Ordinary ... ... | 1 | 8 | 8 | 26/- | — | 5 7 8 |
| Lancs. Light and Power ... ... | 1 | 7½ | 7 | 27/- | — | 5 3 9 |
| London Electric ... ... ... | 1 | 8½ | 9 | 29/6 | — | 4 15 0 |
| Metropolitan ... ... ... ... | 1 | 9 | 10 | 41/3 | — | 4 17 0 |
| do. 4½% Pref. ... ... | 1 | 4½ | 4½ | 17/6 | — | 5 2 10 |
| Midland Counties ... ... ... | 1 | 6½ | 7 | 28/6 | — | 4 16 3 |
| Mid. Elec. Power ... ... ... | 1 | 15 | 8 | 32/- | — | 5 0 0 |
| Newcastle-on-Tyne Ordinary ... | 1 | 6 | 6 | 23/3 | — | 5 3 1 |
| do. 7% Pref. ... ... | 1 | 7 | 7 | 25/6 | — | 5 9 10 |
| Notting Hill 6% Pref. ... ... | 10 | 6 | 6 | 10½ | — | 5 11 4 |
| North Met. Elec. 6% Pref.... ... | 1 | 6 | 6 | 22/6 | — | 5 5 9 |
| St. James' and Pall Mall ... ... | 1 | 8 | 8 | 27/6 | — | 5 1 10 |
| Scottish Power ... ... ... | 1 | 8 | 8 | 29/- | — | 5 3 3 |
| South London ... ... ... | 1 | 8½ | 8½ | 27/6 | — | 5 1 10 |
| Urban Ordinary ... ... ... | 1 | 7 | 7 | 32/6xd | —9d. | 4 6 2 |
| Westminster Ordinary ... ... | 1 | 8½ | 8½ | 27/- | — | 5 3 8 |
| Whitehall Elec. Invst. 7½% Pref.... | 1 | 7½ | 7½ | 24/6 | — | 6 2 5 |
| Yorkshire Elec. ... ... ... | 1 | 8 | 8 | 33/- | — | 4 17 0 |

### Home Rails.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented ... | Stock | 4 | 4 | 77 | — | 5 4 0 |
| Metropolitan ... ... ... ... | ,, | 3½ | 4 | 66½ | — | 6 0 4 |
| do. District ... ... ... | ,, | 4 | 5 | 77½ | — | 6 9 0 |
| Underground Electric ... ... | £1 | 7 | 8 | 23/- | +6d. | 6 19 2 |
| do. do. Income ... | Bonds | 6 | 6 | 112 | +3 | 5 17 2 |

### Telegraphs and Telephones

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. ... ... | Stock | 6 | 6 | 103½ | — | 5 16 0 |
| do. Def. ... ... ... | ,, | 1½ | 1½ | 24½ | — | 6 1 3 |
| Automatic Telephone ... ... | 1 | 10 | 12½ | 37/6 | — | 6 13 4 |
| Cables & Wireless 5½ Pref.... ... | Stock | — | 5½ | 92½ | —1 | 5 19 0 |
| do. A 7½ Ord. ... ... | ,, | — | — | 50 | — | ... ... |
| do. B Ord. ... ... | ,, | — | — | 23½ | +1 | ... ... |
| Globe Tel. and T. Ord. ... ... | 10 | 10 | 10 | 20½ | —½ | *4 17 7 |
| do. do. Pref. ... ... | 10 | 6 | 6 | 11½ | — | 5 9 1 |
| Great Northern Tel. ... ... | 10 | 20 | 20 | 32 | — | 6 5 0 |
| Marconi-Marine ... ... | 1 | 12½ | 15 | 1 15/16 | —1/16 | 7 14 8 |
| Oriental Telephone Ord. ... ... | 1 | 12 | 12 | 55/-xd | +1/- | *4 7 3 |

### Home and Foreign Trams, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams First Pref. ... | £ 5 | 5½ | 5½ | 2⅞ | —1/16 | 9 11 2 |
| do. do. 2nd Pref. ... | 5 | 6 | 6 | 2⅞ | — | 10 8 8 |
| do. do. 5% Deb. ... | Stock | 5 | 5 | 70½ | — | 7 0 0 |
| British Electric Traction Def. Ord. | ,, | 5 | 5 | 1750 | — | ... ... |
| do. do. Pref. Ord. | ,, | 8 | 8 | 126½ | — | 6 6 6 |
| Brazil Traction ... ... ... | 100 | 7 | 8 | 51½ | +1½ | 3 17 8 |
| Brit. Columbia Elec. Rly. Pcc. ... | Stock | 5 | 5 | 94½ | — | 5 7 0 |
| London & Sub. Trac. 5% Pref. ... | 1 | Nil | Nil | 10/- | — | ... ... |
| London United Tram Deb. ... | Stock | 4 | 4 | 52½ | — | 7 12 4 |
| Mexico Trams, 5% Bonds ... ... | — | 5 | 5 | 70 | — | 7 2 10 |
| Mexican Light Common ... ... | 100 | Nil | Nil | 8½ | — | ... ... |
| do. 7% Pref. ... ... ... | 100 | 7 | 7 | 76½ | — | 9 3 0 |
| do. 1st Bonds ... ... | — | 5 | 5 | 81 | — | 6 5 0 |
| Victoria Falls Ord. ... ... ... | 1 | 15 | 15 | 63/3 | — | 4 14 4 |
| Yorkshire (West Riding) ... ... | | Nil | Nil | 5/- | — | ... ... |

### Manufacturing Companies.

| | | | | | | |
|---|---|---|---|---|---|---|
| Assoc. Elec. Ord. ... ... ... | £ 1 | 6 | 6 | 27/- | —6d. | 4 9 0 |
| Babcock & Wilcox ... ... ... | 1 | 13 | 15 | 58/- | +1/9 | *5 3 0 |
| British Aluminium Ord. ... ... | 1 | 10 | 10 | 43/- | —2/- | 4 3 0 |
| British Elec. Transformer Pref. ... | 1 | 7 | 7 | 8/9 | — | ... ... |
| British Insulated Ord. ... ... | 1 | 15 | 15 | 3¾ | — | 4 0 0 |
| Brush Ord. ... ... ... | Stock | 10 | 10 | 120xd | — | 8 6 8 |
| Callenders ... ... ... | 1 | 15 | 15 | 3¾ | — | 4 3 0 |
| do. 6½% Pref. ... ... | 1 | 6½ | 6½ | 23/9 | — | 5 9 5 |
| Crompton Parkinson Ord. ... ... | 5/- | — | 80 | 23/9 | — | 6 16 4 |
| do. 8% Pref. ... ... | 1 | 8 | 8 | 24/6 | — | 6 10 8 |
| Edison-Swan 1st. Pref. ... ... | 1 | 7½ | 7½ | 24/6 | — | 7 1 2 |
| do. 5% Deb. ... ... | Stock | 5 | 5 | 84½ | — | 5 18 4 |
| Electric Construction ... ... | 1 | 5½ | 5 | 13/3 | —3/- | 7 11 0 |
| Enfield Cable Ord. ... ... | 1 | 20 | 20 | 4½ | — | 4 14 1 |
| English Electric ... ... ... | 1 | Nil | Nil | 2/9 | — | ... .. |
| do. do. Pref. ... ... | 1 | 3 | Nil | 7/6 | — | ... ... |
| Gen. Elec. Pref. ... ... ... | 1 | 6½ | 6½ | 23/6 | — | 5 10 7 |
| do. Ord. ... ... ... | 1 | 10 | 10 | 80/- | —½ | 4 0 0 |
| Henley ... ... ... ... | 1 | 25 | 30 | 6½ | —¼ | 4 15 10 |
| do. 4½% Pref. ... ... | 5 | 4½ | 4½ | 4½ | — | 5 6 0 |
| India-Rubber ... ... ... | 1 | Nil | Nil | 10/- | — | ... ... |
| Johnson & Phillips ... ... ... | 1 | 10 | 10 | 1¾ | — | 5 6 8 |
| Siemens Ord. ... ... ... | 1 | 7½ | 7½ | 24/6 | — | 6 2 5 |
| Telegraph Construction ... ... | 12 | 10 | 10 | 20½ | — | *5 17 0 |

* Dividends paid free of Income Tax.

# Published Specifications.

### 1928.

32,255. "Electric motors." D. B. Hoseason and Associated Electrical Industries, Ltd. November 5th, 1928. (Cognate application, 26,900/29.) (328,661.)

35,985. "Electric resistance dimming switch." J. W Mears. September 3rd, 1929. (328,376.)

38,139. "Electric switches." B. W. Handley and G. B. Handley. December 27th, 1928. (Cognate applications, 14,215/29 and 29,132/29.) (328,589.)

38,182. "Means for transmitting electric impulses." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). December 27th, 1928. (328,549.)

### 1929.

10. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 1st, 1929. (328,641.)

2,591. "Transformers for use in rectifier installations." Akt. Ges. Brown, Boveri et Cie. February 13th, 1928. (Patent of addition not granted.) (305,983.)

2,662. "No-volt overload tripping mechanism for electrical switches.' Allen West & Co., Ltd., and F. J. Pavitt. January 25th, 1929. (328,560.)

2,744. "Electrical gramophone pick-ups and the like." S. Lyle (H. B Lyle). January 26th, 1929. (328,595.)

2,756. "Electric radiator fires." S. Z. de Ferranti and Ferranti, Ltd. January 26th, 1929. (Addition to 300,565.) (328,561.)

2,850. "Electro-deposition of a coating of zinc." Q. Marino. January 28th, 1928. (305,035.)

2,898. "Installation comprising a movable X-ray tube." C. H. F. Müller Akt. Ges. January 27th, 1928. (305,044.)

2,962. "Electric couplings." A. C. Wynne. January 29th, 1929. (328,568.)

3,002. "Systems for giving indications of electrical conditions at a distance." British Thomson-Houston Co., Ltd., and F. H. Clough. January 29th, 1929. (328,569.)

3,033. "Radio and the like amplifiers." H. J. Round. January 29th, 1929. (328,575.)

3,041. "Driving arrangements for telegraphic apparatus." P. C. Doignon. January 29th, 1929. (328,578.)

3,173. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., R. Taylor, and C. E. Beale. January 30th, 1929. (328,605.)

3,272. "Telephone systems." Standard Telephones and Cables, Ltd., and T. S. Skillman. January 31st, 1929. (328,609.)

3,273. "Switching arrangements for use in automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and J. H. E. Baker. January 31st, 1929. (328,610.)

3,274. "Telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker, and L. B. Haigh. January 31st, 1929. (328,611.)

3,282. "Method of suppressing echo effects in telephone circuits." C. Robinson and F. P. Lampard. January 31st, 1929. (328,612.)

3,338. "Television apparatus and the like." J. L. Baird and Television, Ltd. January 31st, 1929. (Cognate application, 3,748/29.) (328,616.)

3,630. "Production and/or modulation of periodic electric currents." J. H. O. Harries. February 4th, 1929. (328,680.)

3,921. "Electric relays." M. B. Richter. February 5th, 1929. (328,690.)

4,968. "Luminous electric discharge tubes." General Electric Co., Ltd. July 13th, 1928. (315,386.)

6,082. "Electric signs of the monogrammic type." W. Donegani. February 25th, 1929. (328,720.)

6,186. "Electric motors." J. Zetsche, N. Petersen, and J. Sinclair-Ross. February 25th, 1929. (328,722.)

8,205. "Automatic advance and retard ignition devices for magneto-electric machines." British Thomson-Houston Co., Ltd., C. J. Morton, and T. H. Woodfield. March 13th, 1929 (328,731.)

8,902. "Electric cable couplings for use on railway vehicles." National Malleable and Steel Castings Co. March 20th, 1928. (308,263.)

9,705. "Automatic and semi-automatic telephone systems" Siemens Bros. and Co., Ltd., and C. L. Peters. March 26th, 1929. (328,732.)

9,749. "Electric ranges." H. Wade (Moffats, Ltd.). March 26th, 1929. (328,754.)

9,962. "Venting devices for use in electric accumulators." W. R. Edwards. March 28th, 1929. (328,756.)

10,954. "Electric discharge tubes." M-O Valve Co., Ltd., and W. H. Peters. April 9th, 1929. (328,763.)

11,934. "Current transformers." Siemens-Schuckertwerke Akt. Ges. and F. Wellhofer. April 17th, 1929. (328,772.)

12,149. "Electric accumulators." S. Frais. April 19th, 1929. (Cognate application, 23,507/29.) (328,774.)

12,232. "Automatic electric cut-outs." A. Peloux. April 19th, 1929. (328,776.)

12,501. "Telephone systems." Staat der Nederlanden. November 23rd, 1928. (328,779.)

12,756. "Impulse senders of the finger-disk type." Telefonaktiebolaget L. M. Ericsson. May 8th, 1928. (311,274.)

13,103. "Clamps for electric conductors." J. W. Hofmann (trading as a firm). August 10th, 1928. (317,069.)

14,072. "Electric motor control." British Thomson-Houston Co., Ltd. May 7th, 1928. (311,234.)

14,088. "Electric water heaters." H. H. Berry and C. A. Painton. May 6th, 1929. (Cognate application, 19,533/29.) (328,802.)

14,382. "Sliding or dropping carriage switchgear in enclosed distributing installations." Siemens-Schuckertwerke Akt. Ges. May 25th, 1928. (Patent of addition not granted.) (312,353.)

14,560. "Impulse circuits particularly for use in automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. May 12th, 1928. (311,412.)

16,797. "Electric stop motions for drawing boxes for wool, worsted, and like fibres." W. J. Scott. May 31st, 1928. (312,694.)

17,455. "Surge-protection arrangement for electric plants of low operating voltage." Maschinenfabrik Oerlikon. April 5th, 1929. (328,839.)

18,485. "Dynamo-electric machines." Associated Electrical Industries, Ltd. June 16th, 1928. (313,625.)

16, 486. "Electrical insulators." Associated Electrical Industries, Ltd. June 16th, 1928. (313,626.)

18,859. "Magnetos." J. E Pollak (Excel Magneto Co.). June 19th, 1929. (328,846.)

19,020. "Methods of manufacturing laminated magnetic bodies and the like." International General Electric Co., Inc. June 22nd, 1928. (314,084.)

19,129. "Arrangements for tuning high-frequency circuits." Telefunken Ges. für Drahtlose Telegraphie. June 23rd, 1928. (314,089.)

19,361. "Spark plugs." E. Hamm June 24th, 1929. (Convention date not granted.) (314,307.)

20,368. "Thermal electric cut-out devices for electrically-heated kettles, irons, and the like." G. Pate and J. R. Laird July 3rd, 1929. (328,857.)

21,744. "Electric insulators." Steatit-Magnesia Akt. Ges. September 20th, 1928. (319,317.)

21,909. "Electric lampholder adapters." E. Ellwood. July 17th, 1929. (328,867.)

23,431. "Polyphase induction motors." Siemens-Schuckertwerke Akt. Ges. September 26th, 1928. (319,684.)

25,065. "Electrical connectors of the plug-and-socket type." W. E. Watson and M.K. Electric, Ltd. August 16th, 1929. (328,886.)

30,164. "Regulating devices for the driving turbine of a machine operated alternatively by an electric motor and a turbine." International General Electric Co., Inc. October 4th, 1928. (328,903.)

30,758. "Transformers." British Thomson-Houston Co., Ltd. October 10th, 1928. (328,904.)

35,530. "Television apparatus and the like." J. L. Baird and Television, Ltd. February 4th, 1929. (Divided application on 328,616.) (328,691.)

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328. "Electrical sound-reproducing apparatus." W. L. Colassi. April 26th, 1929. (Divided application on 30,815/28.) (328,906.)

6,764. "Electric high-tension systems." Condit Electrical Manufacturing Corporation. December 13th, 1927. (Divided application on 302,273.) (328,656.)

# Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 21st:—

Delco-Remy. No. 497,701. Class 6. Electric starting, lighting, and ignition machinery, electric motors and dynamos, and component parts thereof, &c. No. 497,702. Class 13. Electriee switches (ordinary), electric circuit-breakers, &c.—Delco-Remy Corporation, 2,407, Columbus Avenue, Anderson, Ind., U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

B.B., Britannia Batteries, Ltd. (lettering and design). No. 505,550. Class 8. Primary and secondary batteries and parts thereof.—Britannia Batteries, Ltd., Britannia House, 233, Shaftesbury Avenue, W.C.2.

Consul. No. 510,336. Class 8. Wireless telephonic apparatus and parts thereof.—Dora Vale, trading as the Consul Radio Co., 62, Miller Street, Aston, Birmingham.

Hopkinsons. No. 506,195. Class 8. Electric controlling apparatus for steam, gas, water, and air valves, &c.—Hopkinsons, Ltd., Britannia Works, Birkby, Huddersfield.

Marvotone. No. 510,394. Class 8. Sound recording and reproducing apparatus, &c.—Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2.

K.E.C. (lettering and design). No. 511,753. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Kenbar Electrical Co., Pound Lane, Willesden, N.W.10.

Compass. No. 512,000. Class 8. Wireless telephonic apparatus, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Tarzan. No. 512,146. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Worple Road, Isleworth, Middlesex.

Cons Tell Aray, C.E.E.A.S., Ltd. (lettering and design). No. 511,781. Class 13. Lampholders for flood and spot lights, &c.—Central Electric Engineers' Accessories Supply, Ltd., 193, Bethnal Green Road, E.C.2.

# Forthcoming Events.

**Institution of Electrical Engineers.**—June 2nd to 7th. Summer meeting in Ireland.

**(London Students' Section).**—August 2nd to 13th. Summer meeting in the Ruhr district (Germany) and Switzerland.

**Illuminating Engineering Society.**—Tuesday, June 3rd. Annual meeting.

**Tramways, Light Railways and Transport Association.**—Hastings. June 11th to 13th. Annual congress.

**World Power Conference.**—Berlin. June 16th to 25th.

**Electrical Contractors' Association.**—Llandudno. June 25th to 27th. Annual convention.

**Association of Mining Electrical Engineers.**—June 24th to 28th. Annual convention in London.

**Faraday Society.**—Wednesday, June 4th. King's College, Strand, W.C. 5.30 p.m. Papers on "Analysis by X-rays," by Prof. T. H. Laby and Mr. J. T. Calvert.

**British Association.**—September 3rd to 10th. Bristol. Annual meeting.

## Patents.

"The year has been marked by steady progress, especially in the chemical and electrical industries, but no very outstanding development can be identified."

Such is the opinion expressed in the 1929-30 annual report of the Comptroller-General of Patents. The record number of 39,898 applications for patents was received, while the complete specifications filed (25,386) exceeded by 1,341 the number received in 1928, and was the largest number received in any year. There was a reduction in the number of applications for trade marks, the total of 11,753 being a decrease of 931 on 1928. The total receipts for last year were £578,206, an increase of £33,466. The surplus of receipts over expenditure was £157,005. In the electrical field rapid development is taking place in connection with electric gas and vapour discharge lamps for general lighting, for use in advertising signs, and for producing ultra-violet radiation for therapeutic purposes and the treatment of food. In connection with talking-picture apparatus, improvements are being made in photo-electric cells of the electric-discharge type, and there is a marked increase in applications relating to the construction of thermionic valves for radio and other uses. Compared with 1927 and 1928, there has been an increase of nearly 50 per cent. in applications concerned with circuits for wireless signalling, and a similar increase in connection with television and copying telegraphs.

# New Work for Contractors.

**Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.**

***Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.***

ALTRINCHAM.—New Regal Cinema, Manchester Road (£40,000); the U.D.C. surveyor.

BERKS.—Schools and extensions for the E.C. (£120,000); director of education, Reading.

BIRKENHEAD.—Houses, Shrewsbury and Lingdale Streets; William Griffiths & Sons, architects. Development, Prenton estate; Mr. Sharples.

BOSTON.—Sawmills, Skirbeck Road, for Harrison & Lewin, Ltd.

BOURNEMOUTH.—Houses (88), Castle estate; J. M. Leyland. Houses (20), Claremont Avenue; S. G. Ward. Church, Cardigan Road; Baptist trustees. Roller-skating rink, Wycliffe Road; J. M. Blackwell. Shop, Commercial Road; Marks & Spencer.

BRADFORD.—Church, Heights Lane, Heaton; hon. sec., Diocesan Board Church Building Committee.

BUCKS.—Schools and extensions for the E.C. (£107,000); director of education, Aylesbury.

CLITHEROE.—Sewage disposal works, Chipping; surveyor to R.D.C.

CROSSHILLS (Airedale).—Church for the New Church Society; Jas. Hartley & Son, architects, Skipton.

DOUGLAS (I.O.M.).—Flats for the T.C.; J. E. Teare, architect, 46, Athol Street (returnable deposit of £10 10s.).

EARLSHEATON (Yorks.).—Re-erection of factory, Bank Top, for Thomas Porritt's, Sons.

EDEN BRIDGE (Kent).—Hospital (£20,000) with electrical and heating work; Messrs. Davison, builders, West Malling, Maidstone.

ERITH.—School (610 places), Belvedere, for the E.C.; D. S. Twigg, clerk.

FAVERSHAM.—Block of eight buildings; British Petroleum Co., Ltd.

GLOSSOP.—Additions to premises, Howard Street; Glossop Carriage Co., Ltd.

GOODMAYES.—Rebuilding premises; F. G. Smith Motors, Ltd., 22, Cranbrook Road, Ilford.

HALIFAX.—Licensed premises, Haley Hill, with electrical work; Walsh & Maddock, architects, 10, Harrison Road.

HAMPSHIRE.—Secondary school, Farnborough, for Hants. E.C.; director of education, Winchester.

HARROGATE.—Premises for Harrogate Masonic Trust, Ltd.; Frank Tranmer, architect, Westminster Chambers.

HAYDOCK.—Houses (26) for the U.D.C.; Mr. Mercer, builder, Clipsley Lane.

HUDDERSFIELD.—Housing scheme (31), Newsome, for the T.C.; borough architect, 26, Ramsden Street. Shops and offices, Market Street; J. Ainley, architect, 55, New Street.

HULL.—Presbyterian church (£10,000); F. J. Parkinson, architect, Blackburn.

IRISH FREE STATE (Dungarvan, Co. Waterford).—Dwellings (23) for U.D.C.; Michael O'Meara, acting town clerk, Town Hall (returnable deposit of £2 2s.).

(Kimmage, Co. Dublin).—Houses (62) for Irish Sailors' and Soldiers' Land Trust; W. J. Brown, architect, 50, Upper Mount Street, Dublin (returnable deposit of £5 5s.).

KENDAL.—Additional 120 houses for the T.C.; borough surveyor. Extensions, ambulance brigade headquarters; John Hutton, architect.

KENT.—Boys' secondary school, Clock House, S.E., for Kent E.C.; Major W. H. Robinson, education architect, Sessions House, Maidstone.

LANARKSHIRE.—Houses (50), Harthill, for the C.C.; clerk, Glasgow.

LICHFIELD.—Additional 42 houses for the T.C.; city surveyor.

LIVERPOOL.—Housing scheme, St. John's Lane, Queen Square and Rose Street, for the General Building Syndicate, Ltd., 36, St. Martin's Lane, London, W.C.2.

LONDON (Shoreditch).—Hospital and dental centre (£9,000); borough engineer.

(E.C.).—Reconstruction of Broad Street station for the L.N.E. Railway Co.

(St. Pancras, N.W.).—Extensions, London Temperance Hospital, Hampstead Road; Sabey & Son (Islington), Ltd.

(Greenwich, S.E.).—Elementary school, Charlton estate (£18,132); F. R. Hipperson & Son.

LONDON (*continued*).

(Bermondsey, S.E.).—Buildings on St. Olave's Church site, Tooley Street; Hay's Wharf, Ltd.

(Catford, S.E.).—Development of Crofton Park estate; H. Cheston & Son.

(Westminster, S.W.).—Extensions, Technical Institute (£50,414); J. & C. Bowyer, Ltd., Upper Norwood.

(Fulham, S.W.).—Buildings on Wesleyan Church site, Chesilton Road; J. R. Wills, Abbey House, Westminster.

(Tooting Bec, S.W.).—New St. Anselm's r.c. Church; Father Warne, rector.

LUTON.—School (1,315 places) for the borough E.C.; Percy Brockbank, architect, County Chambers, Southend-on-Sea (returnable deposit of £3).

MACCLESFIELD.—Labour exchange for H.M. Office of Works, King Charles Street, London, S.W.

MANCHESTER.—R.C. school, Princess Road, West Didsbury; Rev. C. A. Wilkin, 135, Attwood Road, Didsbury. Public baths, Broadway, New Moston, and washhouses: South Street, Longsight; Worksleigh Street, Newton Heath; Moss Side, East and West; Bank Street, Clayton; Queen's Road, Collyhurst; Ashton Old Road, Openshaw; Southern Street, Hulme; Abbey Hey, Gorton North and South; city architect, Town Hall.

MARLOW.—Houses (38) for the U.D.C.; A. C. Dean, builder, High Wycombe.

MORECAMBE.—Town Hall and municipal offices, East End Promenade (£40,000); borough surveyor.

NORTH SHIELDS.—Alterations, Borough Theatre, for Gaumont British Pictures Corporation, Ltd.; J. L. Rose. Additions, Brewers Bank, for Shields Ice and Cold Storage Co.; A. K. Tasker, architect.

NOTTS.—Secondary schools, West Bridgford, Eastwood, and Basford; and extensions, Lilley and Stone High School, Newark, for the Notts. E.C.; county architect.

OLDBURY.—Post office, Albert Street, for H.M. Office of Works, King Charles Street, London, S.W.

PLYMPTON ST. MARY.—Houses (40), Sparkwell, for the R.D.C.; R.D.C. engineer, Underwood House.

PORTLAND.—Electric lighting and heating installation (49 points) at the South Portland Conservative Club, Easton; J. Heritage Seely.

RICKMANSWORTH.—Additional 48 houses for the U.D.C.; Bliss & Son, builders.

ROYSTON (Yorks.).—Houses (120) for the L.M.S. Railway Co.; engineer.

RUSHDEN.—Housing scheme (60) for the U.D.C.; surveyor.

ST. THOMAS.—Houses (20), Alphington, Exminster and Whimple; E. O. Harding, architect, 49, Prospect Park, Exeter.

SANQUHAR.—Drill hall and quarters for the Dumfries-shire Territorial Army Association; secretary, Dumfries.

SEDGLEY.—Houses (34), Summer Lane, Fither estate; U.D.C. surveyor.

SOLIHULL (Birmingham).—Extensions, Solihull school (£40,000); Mr. Thompson, headmaster.

STANLEY (near Wakefield).—Houses (42), Church Lane, Outwood; surveyor to U.D.C., Council offices, Coach Road, Outwood (deposit £2 2s.).

STIRLINGSHIRE.—Additional 63 houses for the C.C.; clerk, Stirling.

SURBITON.—Fire station and baths (£34,000) for the U.D.C.; Joseph Hill, architect.

SWINTON (Lancs.).—Houses (81), Moorfield estate, for J. Lane & Sons, Ltd.

TYNEMOUTH.—Houses (200), Balkwell estate; borough engineer.

WALLSEND.—School for the E.C. (£44,934).

WARDLE.—Houses (63), Ramsden Road and Birch Road; E. A. Stewart, surveyor to U.D.C.

WATFORD.—Development of Purbrook estate: Moore-Smith and Colbeck. Employment exchange, Water Street; H.M. Office of Works. Factory, Bushey Lane; Cowan Hulbert, Ltd. Baths, Elm Street; borough engineer.

WEST SUSSEX.—School, Horsham (£7,900), and re-conditioning Horsham East Parade school (£4,000), for the Sussex E.C.

WINCHESTER.—Offices (£26,444) for Hants. C.C.; A. E. Jukes & Son, builders, Southampton.

WOLVERHAMPTON.—Houses for the T.C.; builders, A. M. Griffiths & Son (50), and H. Taylor (50). Motor-'bus garage (£23,481) for the T.C.; Wilson Lovatt & Sons, Ltd., builders.